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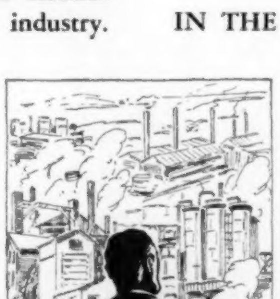
How Is Management Meeting the Test?

IN PEACE TIMES a few army officers occasionally rise to high rank, only to be found lacking later in the special qualifications needed for actual warfare. Likewise in boom times the control of industry often passes into the hands of an offensive leadership incapable of understanding the defensive tactics that seem to be essential in times of depression. Unfortunately, in business there is seldom the middle ground. We swing from excessive optimism to remorseful reaction. Yet the crises such as we struggle through in this period of acute depression are the tests that discipline management or develop new leaders from the rank and file. How does chemical industry stand in this proving process?

THE FIRST and most serious count against chemical management is on the score of the recent price wars. It has violated that most fundamental of all the lessons of the depression; namely, that lower prices do not always stimulate buying, particularly of producers' goods of inflexible demand. Not a pound more alkali was sold merely because quotations were sliced by a third and producers' profits for 1931 sacrificed to the extent of perhaps $15,000,000. Below-cost sales of alcohol have brought very little new business to the industry. Executives in other chemical industries considering price-cutting programs can well take a leaf from the experience of the alkali and alcohol manufacturers. Further unsettling of the chemical price structure will impose a serious penalty on contract buying, which is essential to the successful operation of most of our industries.



WITH more intensive competition there has been a return in some branches of the industry to bad trade practices and unfair dealings. This situation has not been helped by the recent and indecisive activities of governmental agencies that have one day approved and the next day revoked the codes of practice accepted by whole industries. In other quarters there has been a notable weakening in the support of certain trade associations and a growing tendency to cut wage scales rather than to shorten hours or spread the work over the entire payroll.

CONSTRUCTIVE examples of carefully managed chemical industries, on the other hand, are not hard to find. Many long-term programs of expansion and new construction are being carried through to successful completion. Only in rare instances has there been any drastic abandonment of research or curtailment of advertising and developmental work. Merchandising methods are being improved and sales personnel is being strengthened. And a constant flow of new materials, processes, and equipment is gradually adding to the volume and prospective profits of both the makers and users of chemicals.

IN THE AGGREGATE, chemical management ranks high in its acceptance and application of those principles and practices that are codified in the Platform for American Business, first published as a supplement to the March issues of McGraw-Hill publications. Elsewhere in this issue appears the frank comment of a number of engineers and industrialists who see in that exposition a measure of the new value that will come from even better management of chemical industry.

EDITORIALS

MAY, 1931

To Swampscott With The Chemical Engineers

SOME of the newest developments in New England's oldest industries will be seen from a chemical engineering viewpoint June 10-12, when the American Institute of Chemical Engineers meets in Swampscott, Mass., for its twenty-third semi-annual meeting. A technical program with a balanced ration of theory and practice, several unusual visits to plants reflecting the latest technique in such varied fields as the quick-freezing of food products and the contact production of sulphuric acid and, finally, the social events and happy surroundings of a famous shore resort are all attractive features. In short, it is a combination of professional and social activities that Swampscott holds out as its invitation to institute members and chemical engineering guests. May we accept in your behalf?

Another Victory for The Chemical South

PUT at end, for the present at least, is the long process of rumor and conjecture that would have placed an ammonia-soda alkali plant on top of nearly every salt dome along the southern seaboard. Last week the Southern Alkali Corporation, newly formed subsidiary of Pittsburgh Plate Glass and American Cyanamid, exercised its option on a plant site of 350 acres about two miles from Corpus Christi, Texas. It was a gala day for that historic old city. Our reports are that factory whistles were tied down and the streets were full of excited citizens, celebrating the prospect of a $10,000,000 outlay in their community. The figure probably is a bit optimistic for immediate construction, but there is no reason to doubt the eventual completion of a very large unit.

At least one sizable salt dome is within a few miles of the company's acreage, and additional borings are being made. A source of limestone has been tapped near San Antonio. Natural gas is available in abundance and at perhaps 5 cents, or less, per M. cu.ft. A new ship channel will be dredged to connect the proposed plant with the main harbor at Corpus Christi, in order to accommodate ocean-going vessels. All in all, the plan has much in its favor and, if additional alkali-producing capacity is warranted anywhere in the United States, the glowing future of the Chemical South offers the most attractive possibilities.

Chem. & Met. has said so much about these prospective developments that it is gratifying to find the whole situation concisely summarized and interpreted in the April 30 issue of *Manufacturers Record,* sturdy proponent of Southern progress. From the cover of an entire issue devoted to chemical industry we quote this succinct capitulation: ". . . Today, there is established a growing chemical industry based on the South's generous supply of petroleum, natural gas, coal, lignite, sulphur, salt, phosphate, limestone, ores, clays, and many other raw materials, as well as the products and by-products of its forests and crops. In addition to the production in the South of some of the more common and basic chemicals, new and once rare products are being developed. Great plants for nitrogen fixation are shipping out ammonia by the carload. The South has led the country in the manufacture of fertilizer and in production of naval stores. Its cottonseed-oil industry has been increased in value by chemical research. New products and uses for these products are being announced constantly. A primary need of the chemical industry is reasonably cheap power and fuel. The South has these in abundance in its coal, lignite, oil and gas, combined with a hydro-electric development that is steadily being expanded to meet the growing industrial needs of this section. Moreover, its abundant labor supply and transportation facilities and its surface water supply complete the full requirements of successful manufacturing. That is why in a comparatively few years the South has come forward as a great chemical manufacturing region, with an annual output valued at $2,000,000,000. The expansion of the future, however, will be on an even larger scale . . . "

A Depreciation Reserve For Superannuated Employees

INDUSTRY in general recognizes a depreciation on buildings and equipment, but not on labor. When a machine becomes worn out, there is a fund from which to replace it. When a man becomes worn out in satisfactory life-long service of his employer, he is either retained on the payroll for years at a loss to the company or discharged, and is then unable to obtain further employment. If a labor depreciation account could be established it would permit the employer to free the payroll of the costly drain from employees rendered under-efficient by old age and would assure them a means of livelihood during the years when they are no longer able to work.

The necessity for sound pension plans is becoming more and more apparent among the best managed concerns. One of the recently announced programs of this kind is that of the Standard Oil Company of New York. Although administered by an insurance company, it is one of the most ambitious ever undertaken by a private corporation. Pension relations between the corporation and the employees are contractual, rendering the retirement benefits irrevocable. Employees are given the option of participating in the plan, with the provision that a share in the benefits shall not affect their rights under the workmen's compensation law. The company reserves the right to discontinue the plan at any time in the future, but one provision of the agreement with the insurance company is that if the plan is canceled, all annuities purchased for employees up to that time shall remain in force.

The awakening of management to the necessity of replacing present haphazard or insolvent pension plans with scientific annuity reserves promises a new method of dealing with one of the most vital problems with which industries are confronted. It is not too much to expect that eventually some sound pension arrangement, profitable as well as humanitarian, will be developed and universally adopted by the country's employing interests.

A Word of Caution
Regarding Phosphoric Acid

PHOSPHORIC ACID promises to be an increasingly important heavy chemical. This is convincingly demonstrated by the response received by *Chem. & Met.* to the article presented in our January issue discussing the prospect of cheaper phosphoric acid and impending development of industrial phosphates. A large number of corporations, some not even casually referred to in that article, have exhibited an interest in new developments of this character that is most encouraging.

These prospects, however, are not without a minor element of danger. So many concerns have indicated to *Chem. & Met.* their prospective entrance into this field that we feel it worth while to speak a word of warning. The field is large. The prospects are in some respects alluring. But excessive development and the entry of too many active interests would be most unfortunate. We hope that several, but not too many, of those exhibiting an interest in the development of this field will be successful in forwarding their researches and their commercial program. But let no company enter this field with any thought that it may monopolize it. That is clearly an unsafe expectation.

Repumping System Creates
New Steam-Hydro Power Competition

ENGINEERING development of steam-electric power plants has for several years been advancing these properties very successfully in their competition with hydro-electric plants. In fact, in many parts of the country there appear to be almost no sound economic opportunities for much further hydro development. This fact is the result essentially of the much greater capital cost in hydro plants than in steam plants of equal capacity, a disadvantage that is peculiarly evident when the user system has a low capacity-load factor.

Now comes a new element in this competition which has direct importance for public-utility companies and considerable significance to the larger power users in electrochemical and electrometallurgical enterprises. We refer to the scheme for repumping water from below the dam into the storage reservoir above the dam during periods of low power consumption.

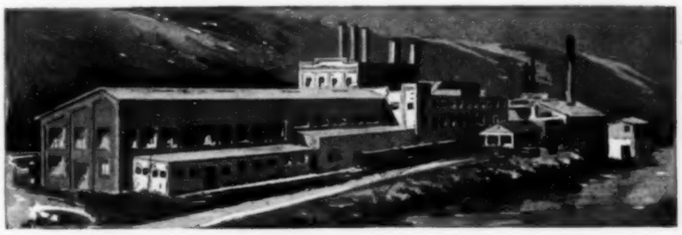
This scheme of making water flow uphill by deliberate pumping from the tail-race pond to the intake reservoir seems, at first sight, to be silly. One logically asks, Why should one generate power from coal and steam simply to pump water uphill and let it flow down again later through the hydroelectric turbine? The answer is that it saves money, a convincing answer at any time. The explanation is simple. The cost of steam-electric power during the night or other low-load periods such as during week ends is very small. Such power can be used for returning water to the upstream storage and thus augment the capacity of the hydro-electric plant for use during peak-load hours. In typical systems it costs perhaps $50 per kilowatt for the pumping system, as in contrast with $80 to $120 per kilowatt for equivalent addition to capacity in the form of an enlarged steam-electric generating station. Thus the peak-load capacity of the whole system is obtained at minimum cost.

The interest in this development for the public-utility concerns is evident. The indirect consequence to big users of power should not be overlooked. It may well be that this development will make the public utility less willing to offer favorable rates for long-hour or off-peak power users than it has been in the past. If so, the big user of power for electrochemical or electrometallurgical work may not find himself so favorably situated with reference to prices for current as he might otherwise have been. Thus there may be a new incentive created for the ownership or partial control of power-generating units to serve such industry, instead of dependence solely on power supply from utility systems.

Random Impressions
Of the Chemical Show

THE thirteenth chemical exposition becomes history. We pause to catalog our impressions. Here they are: (1) Not quite as large as usual (357 exhibits, as compared with 382 in 1929), but certainly a much larger crop of chemical engineering developments. (More than a hundred specific examples of new equipment brought out since the last show by 61 companies are cited in a brief review elsewhere in this issue.) (2) Everywhere a more genuine interest in getting at the real facts—performance data and engineering details of construction. (Less patience with sales talk and window dressings.) (3) Heavy emphasis on materials of construction—particularly plastics and new metals and alloys—but almost complete absence of chemicals. (Thank God for the few manufacturers that were willing to satisfy the chemical engineer's keen interest in new process materials as well as equipment!) (4) New high records for attendance and interest in Dr. Read's worth-while student course. (But can't something be done to give them a better conference room? An atmosphere of din and stench has to be tolerated at times in some chemical plants, but it's an awful handicap to a lecturer and his audience.) (5) A better crowd than ever of good, sociable fellowmen. (All said and done, the human contacts were probably the single most important attraction of the whole show.)

So much for our impressions. They mean most, of course, to the one impressed. And that leads right back to the only safe conclusion: The show's over. If you missed it, it's just too bad. There won't be another until the week of February 27, 1933.



Getting the Jump on BUSINESS

By CHARLES BELKNAP
President
Merrimac Chemical Company
Everett, Mass.

With a species of foresight and confidence in the future very conspicuous by its rarity these gloomy days, the Merrimac Chemical Company is busy spending two-and-a-quarter million dollars to set its house in order against the day when business will boom again. How it is doing so and what it is accomplishing should be an inspiration and a challenge to every branch of chemical industry. Our personal inspection of the results of the Merrimac program convinces us that a great deal less modesty than is found in Mr. Belknap's account would have been amply justified.
—The Editor

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ECONOMISTS generally disagree as to suitable methods for banishing or alleviating the recessions of the business cycle, but I believe I will not be challenged in affirming that they recommend unanimously the use of slack periods for rationalizing and replenishing productive equipment. In such times labor is plentiful, materials are cheap, and production can be interrupted without disastrous effects. In fact, a decrease in output will, more often than not, be an actual benefit or even a positive necessity.

Why then, in the face of these opportunities have so few industrial concerns responded to governmental exhortations and the reiterations of economists and the business press? It is true that credit has been tight, but the greater part of the blame must be assigned to that unfortunate brand of super-caution which puts management on the defensive during every business depression.

I do not wish to claim for my own company any extraordinary share of courage, but I do wish to show how a combination of circumstances, plus a feeling of confidence in the future of industrial New England, has enabled the Monsanto Chemical Works to embark on a $2\frac{1}{4}$ million dollar program of rebuilding and consolidation at the plant of its subsidiary, the Merrimac Chemical Co., and thus to accomplish a long-felt need at a minimum of expense. And, further, I wish to show how the Merrimac company has been able to retain its normal personnel and even to add a hundred names to its payroll, in spite of one of the worst unemployment periods this country has ever experienced.

The story behind the consolidation program goes back to the company's early beginnings. The original bearer of the Merrimac name was the Woburn plant, which was founded in 1853. The Cochrane Chemical Co., engaged in producing heavy chemicals at Everett, was acquired by Merrimac in 1917, and this was followed seven years later by the purchase of the Anderson Chemical Co., a New Jersey concern manufacturing solvents and lacquers. The operations of the second subsidiary were moved bodily to Everett at that time. The final step in the company's history was its acquisition in 1929 by the Monsanto Chemical Works, a step which put it in a financial position that made possible the consolidation now in progress.

Decentralization was a burden under which the Merrimac company had been forced to labor from 1917 until the very recent past. It maintained general offices in Boston, and secondary offices at the Woburn and Everett plants. More serious was the separation of production activities and the less desirable transportation facilities at the Woburn works. It had been recognized for a number of years that the ideal situation would be consolidation of the two plants at Everett, but the physical difficulties in the way of such a merging were very great and its realization consequently was long delayed.

Nevertheless, the advantages of a consolidation at Everett were obvious and real. First, it would permit

Left: Looking Toward the Merrimac Plant From the North; 60 Per Cent of the Consolidation Has Been Completed

Below: "Main Street" in the Everett Plant; Buildings in the Foreground Include the New General Offices, Alum Plant, Power House, and Contact Acid Plant

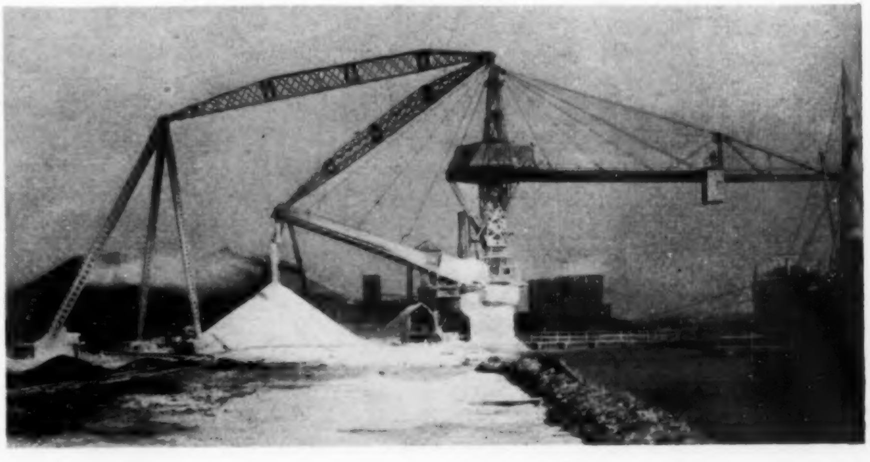
RECOVERY

concentration of management and the elimination of duplicated overhead within a modern industrial community only a few minutes from the center of Boston. Second, the location itself, apart from its close proximity to Boston, had many attractive possibilities. In the matter of space, there was ample for future expansion of the company as well as for the plants of consuming industries which might later seek adjacent sites to take advantage of the excellent terminal facilities and the pipe-line delivery of Merrimac products. From the standpoint of transportation, it seemed difficult to improve on the Everett location. Two sides of the property are bounded by the Mystic and Malden rivers, the former of which is navigable by ocean-going steamers. The company dock is situated on a dredged basin opening into the Mystic River, where the docking facilities are sufficient for vessels of 5,000 tons capacity and a draft of 22 ft. There is additional berth space for the 150-ft. Diesel freighter now operated by one of the company's subsidiaries. With the principal raw materials comprising such heavy-tonnage minerals as bauxite from British Guiana, sodium nitrate from Chile or Virginia, and sulphur from Texas, the elimination of rehandling and freight charges becomes an item of great importance. Inland shipments are accomplished with equal ease since both the Boston & Maine and Boston & Albany railroads run directly through the plant.

In contrast with these features, and aside from an excellent labor supply, the Woburn location had little to recommend it. Its situation, 12 miles inland, on one railroad line, gave it no freight advantage in shipments to customers, and a considerable disadvantage where water-borne raw materials were concerned. In proximity to customers and potential consumers, Everett was again a much more attractive location, for it is situated in the heart of one of New England's most important industrial communities, close to such plants as the Mystic Iron Works, the Beacon Oil Co., and the New England Gas & Coke Co.

There also were other factors demanding the consolidation, although they were less concerned with the choice of location. Modernized production equipment was greatly to be desired: New buildings could be of fireproof construction, subject to much lower insurance rates; new processes could be of greater efficiency; and new equipment geared to the needs of present-day competitive conditions. Thus the value of the move had been thoroughly appreciated for some time, and it had been considered in a preliminary way at least two years ago. What was needed, however, was a catalyzer of some sort, and this was supplied, although in a seemingly disastrous guise, on March 14, 1930.

Entrance for Raw Materials, Exit for Company Products: Loader and Dock on the Mystic River



A fire at the Everett plant on that date destroyed the power house, the alum plant, two chamber units, the machine shop, and the locker building. The immediate requirement obviously was rehabilitation. Very shortly a decision was reached to go the whole way, not only in rebuilding the parts of the works that had been destroyed but also in moving those portions of the Woburn plant worth moving and abandoning and replacing the rest. The engineering department was increased several hundred per cent, designs were made, bids were called for, construction was started. Whereas previous experience had shown that the use of our own facilities was most satisfactory for new construction, it was decided in this case to request outside proposals. Our engineering department, however, was required to submit sealed bids simultaneously on each project, and the wisdom of this course soon became apparent. Although it had formerly been more economical to do our own work, the rock-bottom prices now quoted by the building industry threw the advantage the other way, and we estimate that our savings on account of the depression will amount to 25-30 per cent over 1929 prices. Furthermore, because we insisted in the case of each project that the successful bidder take on, for construction purposes, such of our employees as were not then actively engaged in operation, we were able to retain our personnel intact and avert the lay-offs which would otherwise have been necessary.

An idea of what the consolidation involved may be gained from a hasty survey of the operations carried on at the two plants before the fire. The Woburn plant made sulphuric, nitric, hydrochloric and acetic acids; alum, both commercial and iron-free; glaubers salt; ferric salts; sodium hypochlorite, arsenate, and bisulphite; aluminum chloride; H-acid, Koch acid and other intermediates. The plant occupied 44 buildings and covered 150 acres. The plant at Everett duplicated a good deal of this production and in addition made lacquers and solvents, aqua ammonia, sodium aluminate and ground sulphur.

Another advantage for the Everett location now becomes apparent. Although the number of operations at Woburn was only slightly smaller, a survey indicated that almost complete modernization was in order and the moving of very little equipment was justified. Everett was fortunate in possessing lacquer and solvents plants of recent design and other equipment, notably the contact sulphuric acid units, which required little work to put them into first-class condition; and since the decision involved a minimum in the way of moving, it was possible to build new units for the products formerly made at Woburn without the necessity for shutting down during a transitional period.

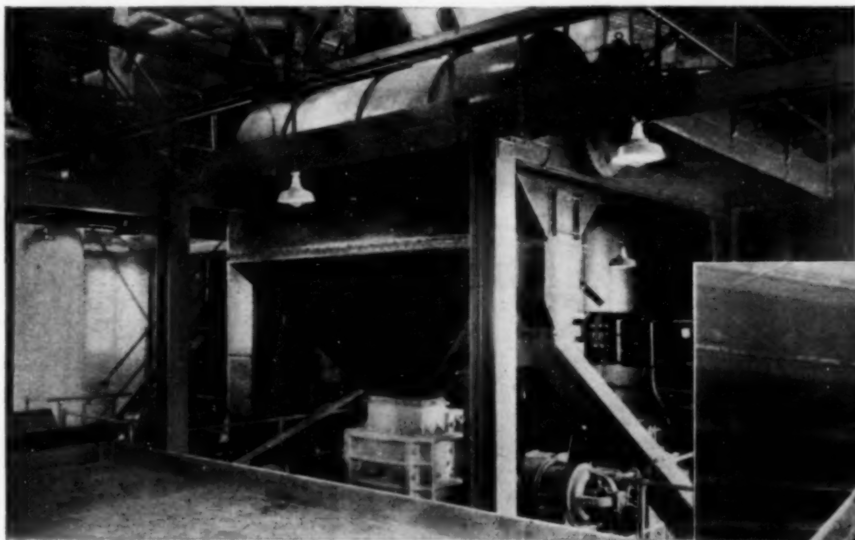
Ground was broken for the first new piece of construction, a locker building, about the first of June, 1930, only 2½ months after the fire. As this account is written, the consolidation is over 60 per cent accomplished. By Oct. 1, 1931, it will have been completed. When that date is reached, all of the plant will be new with the exception of the ammonia, lacquer and solvents, sulphur-grinding and sodium sulphide divisions, and a part of the sulphuric-acid equipment.

The most modern type of factory construction has been employed in all of the new buildings. Walls are of brick, framing of steel, floors of concrete, and roofs principally of interlocking concrete tile. Good lighting and ventilation are provided through the use of large areas of steel casement. All steel work is thoroughly acid-proofed with Mercol, a corrosion-resisting coating of our own manufacture. Building exteriors combine brick and concrete to produce a restrained but attractive appearance well in keeping with the design of the new general office building which has just been opened at the plant.

The new vanadium contact plant is now in operation at its rated capacity of 75 tons daily. Space is provided in the building for a duplicate unit. It is of unique design, differing in several important details from anything previously attempted. (Editor's note: A complete description of the contact plant is to be given before the A.I.Ch.E. in June and published in the June issue of *Chem. & Met.*)

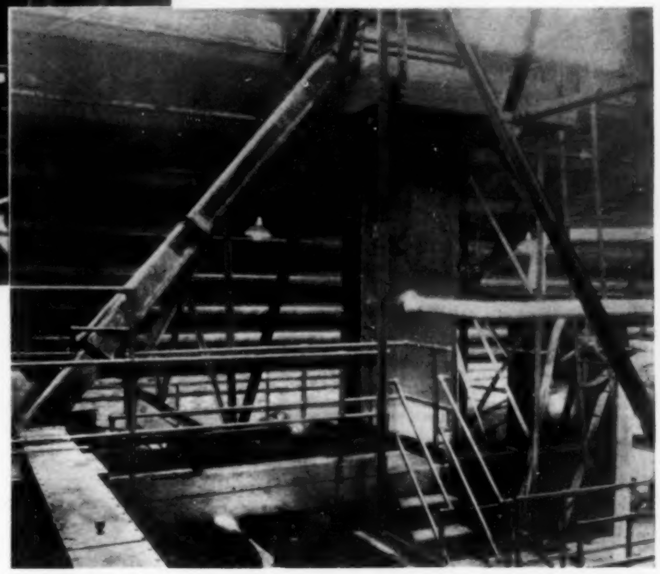
Above: Inside the Nitric Acid Plant, Looking Toward the Pot Settings and Charging Larry From a Position Beside the Bleaching Pot

Left: Outside the Nitric Acid Plant With the Bottling Plant for Aqua Ammonia and the Garage in the Rear



Left: On the Cooling Floor Where Alum Cake Solidifies; Note the Inclosed Trommel Screen, the Hammer Mill and the Apron Conveyor

Below: Conveying Equipment and Steel Storage Hoppers for Finished Lump and Granular Alum



Two buildings comprising the new alum plant contain a number of features in which we take justifiable pride. At present, one chemical unit of half the intended annual capacity has been completed and is in operation. A duplicate unit will be added very soon. The grinding unit for the total expected capacity is entirely finished. Digestion of the bauxite is accomplished by usual methods and the weak liquor clarified by settling and decantation. The dilute product is then pumped to a boiling tank situated in the monitor of the grinding building, from which the concentrated solution can be dropped directly to the two cooling floors below. When the alum cake has cooled, it is broken up by hand and carried on steel apron conveyors to the crushing rolls. Material is elevated for sizing on a trommel screen, from which the undersize feeds directly to a hammer mill for producing a granular product. Large steel bins are used for storing both lump and granular alum, and these feed directly to the shipping and storage department on the ground floor. A feature of the plant is its freedom from alum dust. All dust-producing equipment is completely inclosed and the mills are provided with tubular fabric dust filters.

Our new power plant is small and is being used only to provide process steam, since all electricity can be purchased advantageously. A very novel feature of this plant is its use of the heat absorbed by the cooling air which is supplied to the gas coolers in the new contact unit.

Nitric acid had not, prior to completion of the new plant, been made at Everett for some time. Contrary to general belief, the niter-potting process still has application where niter cake is a necessity. That explains its use in this case. The pots are situated within the building and are arranged for easy replacement. Charging is accomplished by means of a traveling larry which weighs and delivers the necessary quantities of sodium nitrate and sulphuric acid with a minimum of time and labor. Cooling equipment and absorbers are outside the building, together with a correcting tank for the preparation of carload lots of mixed acid.

A new building was constructed around the four existing hydrochloric acid furnaces, leaving space for the installation of two more, should future demands make them necessary. The furnaces are of an improved Mannheim type, using a muffle especially constructed to permit high heat transfer. As in the case of the nitric acid pots, oil firing is used. Special coolers attached to the salt-cake discharge reduce the temperature of this product and deliver it dustlessly to a conveying system which piles it in the storage space provided within the building.

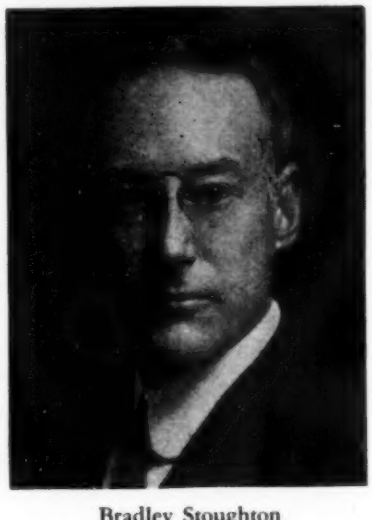
A miscellaneous chemicals building completes the more important new construction that has been accomplished thus far. This contains equipment for the production of ferric salts and sodium hypochlorite. Other buildings include a machine shop, a garage and a bottling plant, the last of which is leased to a concern which bottles and markets our aqua ammonia. Further construction calls for the completion of the second alum digestion unit and the building of the glaubers salt, H-acid, and sodium bisulphite plants. Each of these will be entirely modern in design, the result of intensive work by our research department during recent months. The glaubers salt plant will have as an important feature a continuous method of crystallizing which will replace the enormous area of crystallizing pans formerly necessary.

Just as we anticipated, the results of the consolidation as it has been outlined here have fully equalled and in some cases exceeded our expectations. With the exception of four processes, operations at Woburn have been transferred completely to Everett. Consolidation of all offices at Everett is now an accomplished fact. And within less than five months, the Woburn plant will have closed its gates forever, so far as Merrimac is concerned, with only a "For Sale" sign as a reminder of its former occupant.

It may be seen that these have been heroic measures, but we are finding them worth the expense. We need not look far for their justification, because they have made possible a completely renewed group of producing facilities; because they have provided for greater efficiency in the executive, production, and transportation functions; because they have enabled the Merrimac company to do its part in helping to tide over the depression for its employees; and finally because all these things have been accomplished at considerably smaller cost than would have been possible in normal times.

Electrochemists Discuss Ceramics At Birmingham Meeting

EDITORIAL STAFF REPORT



Bradley Stoughton
Newly Elected President
of the Society

THE twenty-ninth annual convention of the Electrochemical Society was held at Birmingham, Ala., April 23, 24, and 25. Ceramics was one of the important topics discussed. Papers were presented on the applications of electrochemistry to the manufacture of porcelain, glass, Carborundum, and other refractories. New electronic apparatus and devices were exhibited at the new session devoted to that subject. Experts from this country and abroad exchanged experiences in hydrogenation and the hardening of oils at the "round-table luncheon." And the meeting came to a close with the symposium on the electrodeposition of metals and alloys.

To the chemical engineer the session on electrochemistry and ceramics was particularly attractive. Prof. T. N. McVay, of the University of Alabama, who had arranged and sponsored this symposium, presided. Frank H. Riddle, of the Champion Porcelain Co., of Detroit, Mich., recounted how scientific research and extensive practical tests had gone hand in hand in developing a new mullite type refractory from andalusite which in actual service in ignition systems had proved superior to all others.

The Champion company began experimenting with andalusite as a refractory some time before its own deposit was opened, and this development has resulted in a great saving in its own plant, where refractories with an andalusite base have successfully and economically replaced several other high-grade products. All tunnel-kiln car tops, saggers, high-temperature kiln linings, and burner parts are made from this product. Many experiments have shown that andalusite of proper grain size and proportion, when held together with a minimum quantity of a plastic aluminous bond such as clay, makes a desirable active refractory. It is constant in volume during the calcining.

Discussing Mr. Riddle's findings, Louis S. Deitz, of the Western Electric Co., Chicago, emphasized that the cost of materials and processing often eliminated a refractory compound that might otherwise approach the ideal. Dr. Colin G. Fink, of Columbia University, suggested that the spark-plug test might be adapted by others in the ceramic field as a convenient and rapid means of determining relative quality.

An interesting review was that of Prof. Alexander Silverman on electrochemistry applied to glass. The author concluded that electrical conductivity has been utilized as a check on viscosity in glass manufacture; that electrical precipitation is employed for removing suspended matter from producer-gas; and that chromium plating serves as a protective coating in molds for pressing and blowing glass. He further stated that since metals can be sent into the glass by electrolysis, it would seem that the use of protective coatings applied in artistic designs, and subsequent firing of the ware, might prove a possibility in the decorating of glass.

Charles McMullen, of the Carborundum Co., enumerated a few of the more important uses of silicon carbide. It has come to be widely known as a refractory in the form of cements, crucibles, ceramic-kiln furniture, and zinc retorts. One of the most recent adaptations of silicon carbide to modern industry has been its use in regenerator systems, where a large volume of air is to be preheated with maximum efficiency. Silicon carbide combustion chambers are used to great advantage when the requirements include: (1) rapid heat liberation and (2) freedom from contact of soot or smoke with the material being heated; for example, in oil stills, ceramic kilns, and boilers.

The closing paper of the Thursday session was entitled "The Effect of Supports on the Catalytic Activity of Nickel," by Charles R. Glass and Prof. Louis Kahlenberg. The interest in this subject was apparent from the lively and prolonged discussion that followed and was continued during the "round-table luncheon" at which Dr. W. D. Richardson, of Swift & Co., presided.

R. R. Ridgway, of the Norton Co., reported that extensive tests had indicated that Alundum was one of the best supports for the nickel catalyst. Murray Raney,

of the Gilman Paint & Varnish Co., of Chattanooga, Tenn., who has been actively engaged in the hydrogenation field, related his experiences. He had found that a catalyst assaying 33 per cent metal and the balance oxide of nickel was as effective as one assaying 66 per cent metallic nickel.

Dr. Richardson felt convinced that the suboxide theory had no good foundation and that it was the metal that had the catalytic qualities; direct evidence and analogy supported this conclusion. The three metals, nickel, palladium, and platinum, are the good catalysts and they form a vertical "line" in the periodical table of Mendeljeff. Starting out with pure metallic nickel and grinding this in glycerine or oil, in order to avoid or prevent oxidation, an effective catalyst was obtained. Grinding in oil, Dr. Fink argued, would not necessarily prevent oxidation, and he referred to experiences with transformer oil and its dehydration. Dr. H. D. Royce cited the case of grinding nickel in the colloid mill and obtaining a product which was less efficient than the catalyst prepared according to standard practice. Dr. Glass, too, felt that some suboxide was usually present. Dr. Richardson added that the procedure recommended by Glass and Kahlenberg apparently got rid of the objectionable sulphur—the element which is always found in spent catalysts. In retort to this, Dr. Glass stated that barium sulphate was an excellent support for the nickel.

Among the papers that concerned the metallurgists was that by Dr. A. Walter, of Germany, in which he reported upon his experience with electric smelting of zinc; and the studies on zinc and barium ferrites; by J. Guillisen and P. J. Van Rysselberghe, of Stanford University, California. R. F. Cohn's paper on the use of calcium for the removal of bismuth from lead; and the overvoltage of zinc and its alloys with copper, by Prof. M. de Kay Thompson, Massachusetts Institute of Technology, also were interesting.

Perhaps the most interesting development of the entire meeting was the recognition of the relation of electrochemistry and electronics, and the decision of the society to establish a section devoted to this subject. This preceded a symposium on electronics which was ably conducted by Prof. Herman Schlundt, of the University of Missouri. S. C. Lind, B. M. Marks, and G. Glockler, of the University of Minnesota reported upon the results of their experiments on the action of electrical discharge on gaseous hydrocarbons; and on the condensation of hydrocarbons by electrical discharge.

A NEW electro-emitting alloy was described by O. S. Duffendack, R. A. Wolfe, and D. A. Randolph, of the University of Michigan. Dr. Schlundt then showed the new spinthariscope which Dr. H. A. Mangan and he had developed. E. R. Wagner, of the Duovac Radio Tube Corp., described an interesting case of decomposition of iron oxide in vacuum tubes. The closing paper of the session was by O. H. Caldwell, editor of *Electronics,* and James A. Lee, assistant editor of *Chem. & Met.* A number of applications of the vacuum tube and photo-electric cell were described and illustrated.

At the electrodeposition session on Saturday, W. Keitel and H. E. Zschiegner, of Baker & Co., Newark, N. J., reported upon their new di-ammino nitrite bath for the deposition of smooth bright deposits of platinum and palladium.

Prof. S. Glasstone, of Sheffield, England, submitted a detailed study on the limiting current density in the electrodeposition of the noble metals. By means of Fick's law of diffusion an equation is developed whereby it is possible to calculate the maximum value of the current density at which the current efficiency for metal deposition on a cathode can be 100 per cent. It is shown that the values calculated in this manner are in good agreement with the observed values for argentocyanide, cadmicyanide, mercuricyanide, and the cupriammonium solutions.

Theodore Swann an Important Factor in the Success of the Meeting

Limiting current densities of cupriammonium solutions are very much less than the calculated values. The possibility that this discrepancy may be due to slowness of the dissociation of the complex ion is considered, but it is shown that the main cause is the variation of the copper potential as the Cu to CN ratio is altered.

Drs. B. Egeberg and N. Promisel, of the International Silver Co., showed a series of 14 curve diagrams based on a long careful study of silver-plating solutions. They recommend the following conditions for best practice:

For sodium solutions:	Approximately 3 troy oz. Ag./gal. Approximately 4 av./oz. free NaCN/gal. Approximately 6 av./oz. carbonate/gal.
For potassium solutions:	Approximately 3 troy oz. Ag./gal. Approximately 8–10 av./oz. carbonate/gal. Approximately 6 av./oz. free KCN/gal.

To obtain maximum current density without burning plate, use:

(a) higher temperature
(b) higher brightener content
(c) agitation
(d) potassium salts

The brightening effect due to the addition of a small quantity of carbon bisulphide to the silver-plating solution was the chief topic of contention. Dr. Moore suggested the possibility of the formation of xanthate during electrolysis, thus necessitating the renewal of additions of CS_2 from time to time. President Kahlenberg called attention to the fact that most commercial carbon bisulphide contained sulphur in solution. Daniel Gray, of the Oneida Community, Ltd., stated that he had tried potassium ethyl xanthate as an addition agent, but, although adding only a little, got a frosty silver deposit.

Dr. E. B. Sanigar carried out at Columbia University a detailed series of tests on the possibility of substituting a more stable bath for the present silver cyanide bath.

Although a number of promising clues were developed, further research is desirable. Dr. Moore suggested trying out complex organic baths such as the tartrates. Dr. Kahlenberg added that $AgNO_3$ dissolved in pyridine gave satisfactory deposits.

Much favorable comment followed Dr. L. C. Pan's announcement of his bright silver plating from the cyanide bath. Sodium thiosulphate at a concentration of about 1 g./L. was found to be a good brightener for the silver bath, and more effective than carbon bisulphide. The combination of ammonium hydroxide and sodium thiosulphate in a silver bath produces a bright deposit similar to bright chromium, even in the presence of impurities which ordinarily cause dark yellow deposits.

L. E. Stout and Wm. C. Thummel, of Washington University, St. Louis, Mo., reported that the codeposition of silver lowers the reflecting power of electrodeposited cadmium. The tarnishing of the alloys depends both on the composition and on the rate of deposition, and is materially less than that of pure silver. A silver-cadmium alloy containing about 24 per cent of silver recommends itself as the best general-purpose reflector. Its reflecting power is equal to that of pure cadmium, and it is considerably harder and more resistant to abrasion than pure electrodeposited cadmium.

In the discussion of Stout and Thummel's results, attention was called to the fact that tarnish by SO_2 differs appreciably from that by H_2S. There does not seem to be a close parallelism. Prof. O. P. Watts recalled that as far back as 1903 British platers were adding Cd to their silver-plating bath to counteract tarnishing tendencies of the plate. E. M. Wise, of the International Nickel Research Laboratories, stated that, upon substituting another metal for the copper in "sterling" silver, entirely different results were obtained. Zinc in place of copper produced a light lilac-colored tarnish. Dr. Fink advocated chromium for mirrors, even though the reflectivity is but 81 per cent of that of freshly polished silver. Chromium is not affected by either H_2S or SO_2 and the surface of the mirror is extremely hard, so that superficial dust can readily be removed without scratching the surface. The best mirrors, he thought, were the chromium-plated Stellite mirrors.

A NEW abnormality in the properties of aqueous solutions of cadmium salts was reported by Elmer Tesche and Pierre J. Van Rysselberghe, of Stanford University. Electrolysis of aqueous solutions of cadmium iodide yielded cathode deposits containing a large quantity of adsorbed cadmium iodide. Cadmium bromide behaved in the same way, while cadmium chloride yielded normal deposits of pure cadmium. The phenomenon is ascribed to the adsorption of neutral molecules.

An interesting and very striking set of spectrographs were exhibited by Colin G. Fink and F. A. Rohrman, of Columbia University. The evidence was most convincing as to the absence of impurities in the electrolytic nickel prepared by the authors and reported upon at the previous convention of the society.

Dr. J. D. Edwards, of the Aluminum Co. of America, stressed the importance and dependability of spectrographic tests as against chemical or other physical tests. Similarly, Dr. Burns stated that the Bell laboratories resorted to these tests repeatedly for conclusive evidence.

In his contribution to the session, Ernest R. Canning of Birmingham, England, described the high-speed nickel-plating practice of England.

Prof. Watts then reported on his detailed survey in the use of hot nickel-plating solutions by American manufacturers. Many advocated the warm rather than the cold bath.

Dr. Pan, of New York, outlined a very convenient shop procedure for the control of acidity in low pH nickel-plating baths. W. M. Phillips, of the General Motors Corp., showed numerous nickel-plated samples demonstrating that (1) deposits from low pH baths furnish better protection than those from high pH baths; (2) the hardness of deposits is not directly influenced by the pH—nickel is softer from baths operated at elevated temperatures; (3) pitting is no worse with low pH than it is with high pH baths.

Phillips also submitted samples illustrating the "tarnishing" of chromium-plated brass. In the St. Louis district chromium-plated articles appear to have tarnished. Investigation shows that where no nickel or insufficient nickel is first plated over brass or copper articles, this type of failure can occur.

J. W. Cuthbertson, Victoria University, Manchester, England, in his paper, on the electrodeposition of chromium and the influence of the cathode metal, states that nickel is the material mostly used now in England, but is far from ideal. For many purposes copper is a far better undercoating.

TWO chromium studies were received from Japan. One dealt with the three crystalline modifications of electrolytic chromium, by Kumazo Sasaki and Sinkiti Sekito. X-ray spectra were made of chromium electrodeposited from acid chromic sulphate solutions. At current densities below 15 amp./sq.dm., the body-centered cubic form is deposited; above 18 amp./sq.dm., the hexagonal close-packed form; and at intermediate current densities, both the cubic and the hexagonal modification are deposited. The effect of bath temperature is apparent. At 20 deg. C. or below, the hexagonal form was obtained; at 26 deg. C., the body-centered cube only. Chromium plates made from chromic acid baths were always cubical, with a lattice constant equal to 2.877 ± 0.003 A. The hexagonal modification is gradually transformed into the cubic, even at ordinary room temperature.

The other Japanese study was on the electrodeposition of chromium-iron alloys, by G. Fuseya and K. Sasaki.

Prof. Fink and Frank L. Jones gave an account of their researches on tungsten plating and showed numerous samples of the new plate. The deposit is bright and smooth, thoroughly adherent, and exceptionally resistant to acids including hydrochloric.

"Metal Polishing With Flexible Wheels," was the title of Prof. E. M. Baker's paper, in which the various factors, such as grain size and percentage of glue, were discussed at length.

IT WAS the third visit of the Electrochemical Society to Birmingham. An unusually full and attractive program made it almost impossible for those attending the convention to participate in all of the sessions and excursions. About a dozen manufacturing plants had opened their doors to the visitors and generously supplied data and details of their processes. The social events likewise were generously staged. The dinner dance at the Mountain Brook Country Club, the reception at the unique rose gardens of George Ward, and, in particular, the tea at the home of Theodore Swann were most enjoyable and delightful functions.

Improvements Made in Art of Evaporation

By A. L. WEBRE
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Merion, Pa.

THERE are still among us, old-timers of good reputation who insist on maintaining that the evaporators as built today are no better than those of 20 years ago. This contention, of course, has no foundation in fact. Many notable improvements in the art of evaporation have been made in the last 20 years. This development has been contributed by a number of men who have devoted their time and energy to the careful study and scrutiny of evaporator problems, with the object of obtaining better and more efficient results. Among these men might be mentioned Prof. E. W. Kerr, formerly of the Louisiana State University, and W. L. Badger, professor of chemical engineering at the University of Michigan.

It seems to us that the outstanding developments might be summarized as follows:

1. Recognition and use of Rillieux' second principle,
2. Better design and provisions against entrainment losses in evaporators,
3. Development and extensive use of mechanical circulation, where conditions justify,
4. Better arrangement of heating surfaces, as to operation and design, resulting in much higher transmissions than have been thought possible in the past,
5. Elimination of the foam problem by different designs of apparatus.

Going over these subdivisions in detail, we might elaborate as follows:

Rillieux, to whom is generally credited the development of the idea of multiple-effect evaporation, brought out in his original claims two main points which he called his first and second principles. His first principle merely states that in a multiple-effect evaporator a pound of steam supplied to the first effect will give as many pounds of evaporation as there are bodies in the set. This principle was universally recognized from the beginning and has been in use since Rillieux' time with notable success. Many industries are in existence today by virtue of the fact that it is possible to use multiple-effect evaporation as mentioned by Rillieux. His first principle is not absolutely correct. It is not true that we get exactly as many pounds of evaporation as there are number of bodies. On the contrary, this varies according to the conditions under which the evaporator is operated and it may be considerably, more or less, influenced mainly by the temperature of the liquor entering the first effect; also, whether or not the liquor is fed in the order of the bodies or in the reverse order, or in some other sequence. This error is excusable, inasmuch as thermodynamics, as known at that time, did not include the information and data we have at present.

The second principle involves the use of vapors taken from bodies of multiple-effect sets instead of steam for purposes other than evaporation. This idea was not given much recognition until within the last 20 or 25 years, and since that time it has been used more and more with remarkable success. This second principle may be stated as follows:

> The economy of heat in a multiple effect through the utilization of vapors instead of steam is equal to the sum of the vapors taken from each body multiplied by a number indicating its position in the series and divided by the total number of bodies in the system.

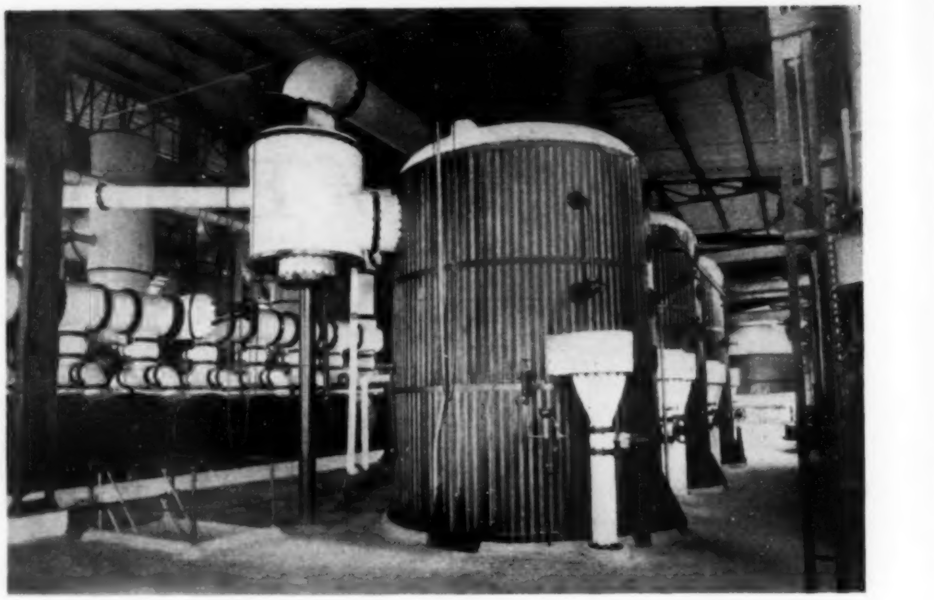
This statement is subject to a slight correction, but is much nearer the truth than the original first principle. The variation is relatively small, amounting to perhaps 4 or 5 per cent, according to the conditions of operation.

Many plants today use steam for heating operations, which could be done with vapors at a relatively small expense. We might mention as an example, the heating of water in paper mills for washing the pulp. Particularly in cold climates, where the largest number of paper mills are in operation, the water must be heated through a considerable range, offering great possibilities for heat economies. We know of one plant in which this is elaborated nicely as follows: The filtered water to be heated is used as injection water in the condenser of one evaporator, requiring very high vacuum. The temperature of the water leaving this condenser is approximately 100 deg. F. From this point the same water is put through a condenser of another evaporator which does not require such a high vacuum, and the temperature is increased from 100 deg. F. approximately to 125 deg. F. In turn this same water at 125 deg. F. is used on the condenser of a third evaporator operating at relatively low vacuum and the temperature is raised from 125 deg. F. to 160 deg. F. It is evident that since all of this heat is "free heat"—namely, heat that would have to be destroyed in the condenser—the saving of steam is great and has resulted in a material reduction in fuel consumption.

In the sugar industry we have interesting examples of the use of Rillieux' second principle. There is hardly a factory in Cuba that does not use vapors for heating the cold juice. These vapors usually are taken from the first effect of a multiple-effect series, and in some cases from the second effect. There are a number of installations in successful operation in which a triple effect is operated using exhaust steam on the first body, and utilizing vapors from the third effect at 205 deg. F. for heating the juice from a temperature of 90 deg. F. to 200 deg. F.

Under normal operation a sugar factory uses the fiber from the cane for fuel. If the "bagasse" is as much as 10 per cent, the fuel requirements of the mill having an ordinary quadruple effect with steam heating and steam pans are satisfied and no additional fuel is required. It is possible by the utilization of Rillieux' second principle in vapor heating and vapor-pan operation, to cut down the fuel requirements so that the factory is balanced with as

A 28,500-Sq.Ft. Triple-Effect Evaporator Supplying Vapors for Juice Heating and Vacuum-Pan Operation



low as 6 per cent fiber. When the fiber content of the cane is 10 per cent, there remains 40 per cent of the fiber available for other purposes. It is also possible under those conditions to operate not only the sugar factory but a refinery, in which all sugars can be remelted and refined, without the use of extra fuel.

The principal interest in the use of these super-economies is the fact that if a new plant is to be built, equipment can be purchased and installed at practically no additional cost. The saving of steam in the plant itself reduces the boiler horsepower necessary, and the decreased boiler capacity more than makes up the additional cost of equipment to effect the steam savings.

Every evaporator is supplied with catchalls or separators in the vapor pipes leading from one effect to the next and in the vapor pipe from the last effect to the condenser. These catchalls or separators usually were built according to accepted standards and it was taken for granted that they did their work satisfactorily. We have had reason to suspect that the performance of these so-called separators was not satisfactory. In the process of evaporation, in which the bubbles break loose from the boiling surface, a careful examination of the conditions existing in the vapor space will reveal the astonishing fact that this vapor space is filled with very small bubbles whose bulk is great and whose weight is relatively very light. As a result, these bubbles float on the rapidly moving vapor currents as they leave the evaporator. Unless extraordinary precautions are taken, they will pass out with the vapor and be lost in the condensates of the succeeding steam belt, or in the condenser of the last body. The condition is not serious under pressure or low vacuum. But under last body conditions, with vacuum from 25 in. to 27 in., the bubbles become larger and lighter, and in view of the much increased volume of vapors and therefore rapid flow, it is easy for these to be carried over, with consequent loss in the condenser.

We have found that the essential principle in the proper recovery of entrainment losses consists in making these microscopic bubbles impinge on wetted surfaces. This is done in order that they may break up and merge into normal sized drops, whose specific gravity is such that they are not susceptible to being carried over by the vapor current. A successful scheme for assisting in this work consists in placing two semicircular baffles set on opposite sides, one above the other in the vapor space of the evaporator. These constitute wetted surfaces against which the microscopic bubbles may impinge and form drops. This is not adequate to complete the separation of the liquor from the vapor and an additional separator usually is necessary.

Catchalls must be carefully designed, the best form being the centrifugal type in which the bubbles are scrubbed against the sides of a cylindrical container and the saved liquor drained by gravity into the vapor space of the particular body under consideration. This point is of importance and certain precautions must be taken to provide against loss from the drain pipe. It is true that there is a difference of pressure between the evaporator and the inside of the separator; otherwise, there would be no flow of vapor. And if the drain pipe from the separator to the evaporator is not sealed in the liquor, there will be a vapor current going up the drain pipe into the separator. This will prevent the passage of liquor downward and cause it to be blown up into the top of the separator with eventual loss.

In a number of cases a centrifugal separator is installed between the evaporator catchall and the condenser and a large quantity of liquors is recovered. In one sugar factory this amounted to $18,000 worth of material in three months, while the cost of the separator was only $5,000.

For many years it has been necessary to provide forced circulation for certain solutions in which there is a precipitation of crystals. This is particularly true of the salt industry, where mechanical circulation has been used. Without mechanical circulation there is an accumulation of crystallized salt which forms on the tubes of the evaporator. This quickly reduces the heat transmission to subnormal proportions, and it is necessary to shut down and washout frequently. The use of the mechanical circulator stops the formation of salt on the tubes, inasmuch as the transmission of heat occurs in an entirely different manner. Without mechanical circulation the level of the brine or liquor in the tubes is carried considerably below the upper tube sheet; in some cases 25 per cent of the height of the tube. With mechanical circulation, however, the level of the liquor is carried perhaps 2 ft. above the upper tube sheet and no boiling takes place in the tubes. The brine is merely heated and allowed to flash into vapor as it reaches the boiling surface. Since the solubility of most salts is greater in hot solutions than cold, there will be no crystallization of salt on the tubes themselves. Where considerable calcium and magnesium —carbonates and sulphates—occur in the solution, scale may accumulate on the heating surfaces. However, if the circulation is sufficiently rapid, even this scale will not form and the tubes will remain relatively clean. In a great many plants this principle is utilized with success.

For evaporating electrolytic brine containing caustic and sodium chloride, Professor Badger has developed an evaporator with very rapid circulation, in the neighborhood of 8 to 10 ft. per sec., in which no salt what-

ever accumulates on the inside of the tubes. It is scoured out by the rapid current of brine passing through.

In the sugar industry, in the operation of the vacuum pans in which the sucrose is crystallized from the mother liquor, there has been considerable work done recently for the purpose of providing adequate mechanical circulation. It has been found that by its use it is possible to obtain better results in the exhaustion of the molasses, or mother liquor, in addition to the fact that the unit operates much faster than it did before. And the heat transmission is so efficient that it is possible to use lower pressure steam. This principle has been used successfully in the utilization of vapors from the multiple effects for the operation of these pans, which has resulted in steam saving and, by virtue of the lower temperature, has decreased the color of the final product, which is a desirable feature.

Heat transmission in evaporators has been considerably improved. This has been due to better design of the heating surfaces, causing steam to flow through them following a predetermined path, enabling the complete and thorough removal of non-condensable gases. These form an insulating film between the steam and the metal of the tubes.

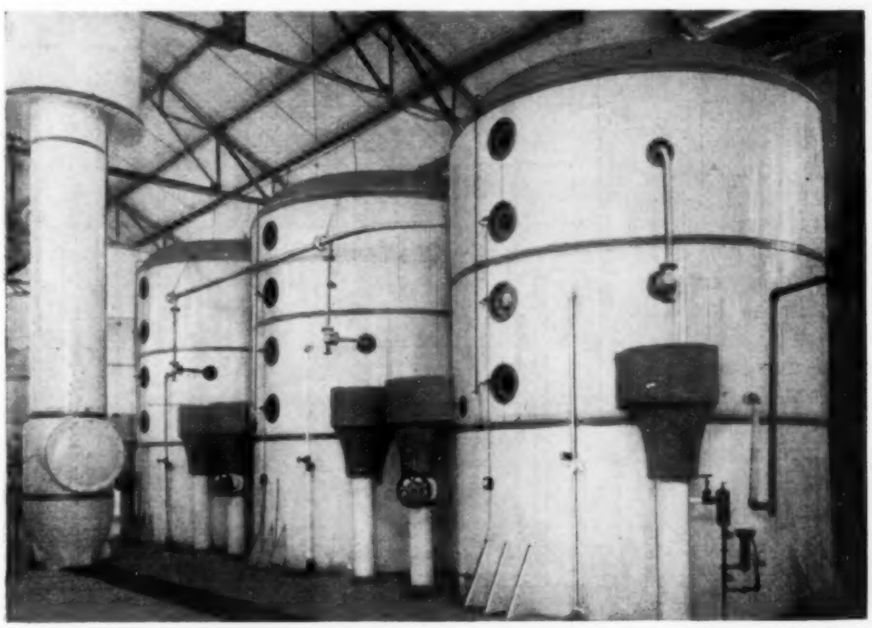
In addition, the proportions of the tubes have been more carefully studied to determine their influence on heat transmission. The diameter and length of these tubes were a matter of tradition and rule of thumb rather than scientific reasoning. It has been found that by decreasing the diameter and increasing the length, the velocity of circulation during ebullition is much greater and as a result the heat transmission is increased. With long tubes of small diameter it is a mistake to think that the hydrostatic head of the liquor in the tubes is so great that it reduces the heat transmission. This is far from being the case, because with these proportions it is possible to maintain a much lower level of liquor and for that reason the hydrostatic head as such does not offer any serious objection. Control of the proper level becomes a delicate and important matter. It has been found that instead of controlling the level of the liquor in tubes it is far better to control the circulation and allow the levels to vary according to the different operating conditions.

It has been our policy to maintain a given froth level above the tube sheet and to allow the levels of the liquors in the tubes to adjust themselves to this froth level. In this case it will be found that the levels of the liquors in the tubes will vary considerably with the conditions under which the evaporator is operated. The temperature of the liquor and the vacuum or pressure under which it is being evaporated, as well as the rate at which the unit is run are influencing factors. It has also been found that the levels vary according to the cleanliness of the tubes; therefore they are always maintained at such a point as to give the maximum heat transmission under the given conditions.

We have had a triple-effect pre-evaporator operating with a steam pressure of 9 to 10 lb. and zero on the third effect, showing heat transmission of the order of 1,200 on the first body, 1,000 on the second, and 600 to 700 on the third. This enables us to operate with a very small temperature difference, the vapors leaving the last effect at such a high temperature as to make their availability for other purposes much greater. Thus the economy of the scheme as a whole is increased. As the length of the tube is increased the quantity of liquor that can be successfully passed through it during evaporation becomes smaller, and as the vacuum is increased the liquor decreases. The subject should be studied carefully in order to obtain maximum efficiency.

In many industrial solutions the surface tension of the liquid is such that considerable foam is formed during evaporation under certain conditions. It has been found that by controlling the tube proportions the foam can be broken up in the tubes themselves and will not exist in the evaporator. This has made the successful evaporation of foamy solutions relatively easy. In evaporators of this type it is necessary to provide extraordinary means for completely separating the bubbles of liquor from the vapor leaving the evaporator, as the rates are very high and the breaking up of the liquid into fine drops is more and more pronounced. The centrifugal separator mentioned previously has given excellent results on this kind of work and can be used with assurance and safety, provided it is properly proportioned and not overloaded. The maximum limits of these separators are approximately 250 to 300 ft. per sec. for vapor velocities under high vacuum, and 100 to 150 ft. under atmospheric conditions or intermediate low vacuum.

From the above it can be seen that notable improvements have been made in the art of evaporation. They have been worked out from the school of practice by patiently trying out different conditions and analyzing the results with a view to providing a logical solution to the problems which present themselves. We think that in the future there will be additional developments enabling us to improve on our present satisfactory performances. Among these might be mentioned the thermo-compressor and the mechanical vapor compressor, whereby steam can be used in one effect and vapor recompressed into the steam belt, giving multiple-effect evaporation in one body. Our efficiency curve on performances has indicated a decided upward trend and we do not know as yet where and when we will reach the peak.



A 24,000-Sq.Ft. Triple-Effect Evaporator, the Vapors From the Third Going to the Juice Heaters' "Dead End"

SOLID CO_2 Technology Defers to Distribution Problems

Completing the study of the CO_2 industry, begun in the March issue with an article on the liquid product, Dr. Reich now presents the commercial prospects of the solidified gas on the basis of present technology and marketing developments

By GUSTAVE T. REICH
*Pennsylvania Sugar Co.
Philadelphia, Pa.*

"THE Miracle of Ice"—thus read the advertisements of ice manufacturers in the daily papers. A person considering solid carbon dioxide may well wonder then how to express *it* appropriately compared to the above. It is only six years since solid carbon dioxide came on the market commercially, and during this short period its consumption has exceeded that of liquid carbon dioxide. A product known for over a century in liquid form and produced as solid by Thilorier in 1834, had not been exploited before 1925, although its chemical and physical properties were well known.

Solid CO_2 goes directly into the gaseous state while water ice is converted first into liquid before it becomes steam. This difference is one of the advantages which enabled solid carbon dioxide to replace water ice in many instances. In the table below are some of the physical properties compared with water ice at atmospheric pressure.

	Solid Carbon Dioxide	Water Ice
Specific gravity	1.53	0.99987
Melting point or sublimation point	—109.6 deg. F.	32 deg. F.
Boiling point	(See Fig. 2)	212 deg. F.
Critical temperature	88.43 deg. F.	689 deg. F.
Critical pressure	1,071 lb. abs.	2860.6 lb. abs. at 32 deg.F.
Latent heat of fusion	82.0 B.t.u.	144 B.t.u.
Latent heat vaporisation	158.6 B.t.u.	1074.29 B.t.u. at 32 deg.F.
Weight per cu.ft. gaseous product at 32 deg. F.	0.117 lb.	0.000304 lb.
Weight per cu.ft. of solid*	90 lb.	57 lb.
Latent heat of sublimation	248 B.t.u.	
Refrigerating effect	275 B.t.u.	144 B.t.u.

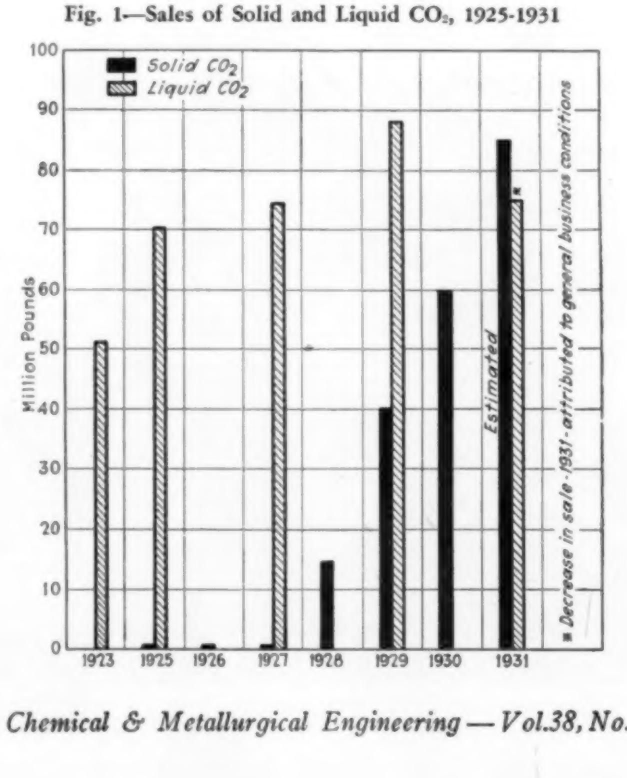
* Based upon solid CO_2 marketed at present.

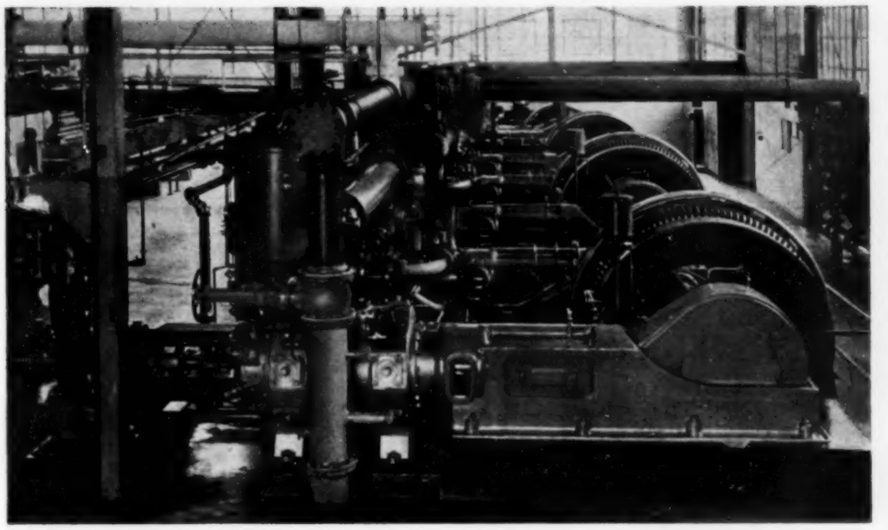
Solid carbon dioxide has about twice the refrigerating effect of water ice and, under such conditions, its commercial value, owing to its higher cost, would appear to be very limited. However, such properties as low temperature range, compactness, cleanliness, dryness, ease in handling, preservative qualities in gaseous form, and better heat insulation than air (being 0.6 at 32 deg. F.), are all points in its favor. Methods of utilizing these properties will be discussed later, and are all important in determining the commercial value.

The advent of the solid CO_2 industry raised a great deal of hope for its replacement of water ice. As with every new industry, hopes are greater than possibilities, and it soon focused the attention of two classes of people, one with ample resources backed by systematic research and technical organization, and the other, promoters—who can be counted by the hundreds. The latter class did a great deal of harm, not being familiar with the underlying principle necessary for a new industry. Jones (*Chem. & Met.* 1930, p. 416) shows the pitfalls which must be avoided for a successful operation.

Solid CO_2 was made by the author in ton lots in 1922, but its actual commercial exploitation started in 1925, according to Slate patents, when its production amounted to only 270,000 lb., compared to the estimated 85,000,000 lb. for 1931, an increase of over 3,000 per cent within six years, as shown in Fig. I. The introduction of solid CO_2 opened new sources of supplies such as gases from calcium carbide furnaces and butanol manufacture. These have stimulated interest in many more remote sources, even to such gas wells as found in the western United States (*National Petroleum News,* 1930, p. 131) and Tampico, Mexico (Martin, *Ind. & Eng. Chem.,* 1931, p. 256). At present, 25 plants manufacture solid carbon dioxide, 80 per cent being operated by the Dry-Ice Corp. of America and the remaining 20 per cent by several others. One of the largest plants, at Peoria, Ill.,

Fig. 1—Sales of Solid and Liquid CO_2, 1925-1931





Compressor Room of DryIce Corp. Plant at Niagara Falls Using Carbide Furnace Gases for Its Capacity of 120 Tons a Day

has a capacity of 50 tons and another at Niagara Falls, N. Y., has a capacity of 120 tons a day.

The solid carbon dioxide industry had to solve the following problems: (1) method of manufacture; (2) storage; (3) containers; (4) distribution; (5) proper application; and (6) sales development. They will be discussed in order, showing the many obstacles the new industry had to overcome in order to make it a success.

This young industry, created an all-around activity expressed in various patents and applications within a few years, and subsequently in interferences and infringement suits.

Thilorier, who made the first solid carbon dioxide on a small scale, was followed by Ducretet (*Compt. Rendus* 99, 235) in 1884. He employed an ebonite cylinder in which two pipes projected almost to the opposite end of the cylinder; one served for the inlet of the gaseous carbon dioxide, and the other, covered at the opening with a gauze, served for the exit.

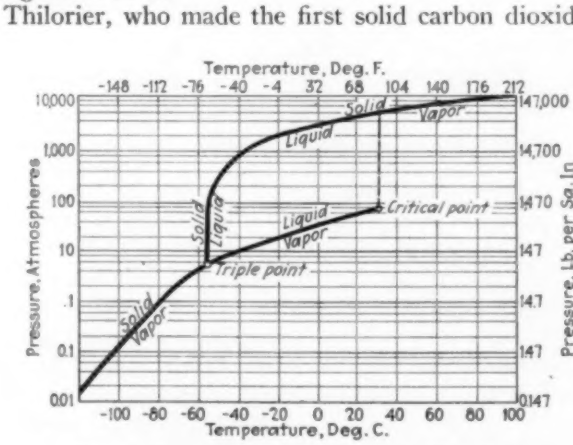


Fig. 2—Boundary Conditions for CO_2 Vapor, Liquid, and Solid (by Cyril H. Meyers)

The simplest method of making solid CO_2 is by expanding the liquid into a canvas bag. In this case about 20-25 per cent of liquid is converted into solid, the remainder escaping as gas. The same principle, applied on a commercial scale, gave a conversion factor of about 33 per cent. Cooling the liquid before entering the solidifying chamber, as practiced in the refrigeration system, and raising of the pressure, increases the conversion factor to almost 50 per cent.

In Fig. 4 are shown the boundary conditions for the solid, liquid, and vapor states of carbon dioxide (according to Cyril H. Meyers, *Ice and Refrigeration*, June, 1929). The utilization of these properties is the basis of the various processes.

Commercial Manufacture

The first machine described by the DryIce Corp. had the appearance of a household boiler, as shown in Fig. 3. It consisted of one inner and one outer shell built out of sheet steel. The inner served for the production of the solid CO_2 and the space between the two shells for the passage of the unsolidified gas. A special nozzle which prevents freezing at its opening, and placed near the bottom of the inner shell, serves for discharging the liquid CO_2. When the latter is under a pressure of approximately 1,100 lb. it is suddenly released and becomes gaseous again, absorbing a large amount of heat which cools and freezes part of it. The solidified CO_2 behaving like snow, drops to the bottom or adheres to the inner shell, while the unsolidified gas escapes through the top of the inner shell, which is covered with a filter cloth to retain the solid material. The cold gas passes down between the inner and outer shell, with cooling and insulating effect, escaping at the bottom and serving for further cooling of the incoming liquid. A cork insulation is provided for the outer shell and the machine rests on a scale. The operation is as follows:

Liquid carbon dioxide, cooled, enters the chamber and is permitted to escape until about 500 lb. of solid material has been produced. With good cooling, about 1,000 lb. of liquid is required. The operation, lasting 20 minutes, is stopped, a manhole opened, and the solid carbon dioxide removed. After closing the manhole, another cycle starts. The snowy material must now be compressed, being very loose and fugitive. It is transferred, therefore, into steel molds 10 in. square, in which it is compressed under 800 lb. pressure per sq.in., forming a solid block 10x10x10 in., weighing about 40 lb. This machine is 3 ft. in diameter and 5 ft. high and is capable of producing 3,000 lb. of solid carbon dioxide daily. For several years this machine was used and laid the foundation of the solid-CO_2 industry.

The snow tank method has been superseded in the DryIce Corporation plants by vertical inclosed presses, serving both for deposition of solid CO_2 directly in the press chamber and also for pressing the blocks to size. While no information has yet been released on the detailed construction of these machines, it is known that they are constructed with cast-steel chamber tested to

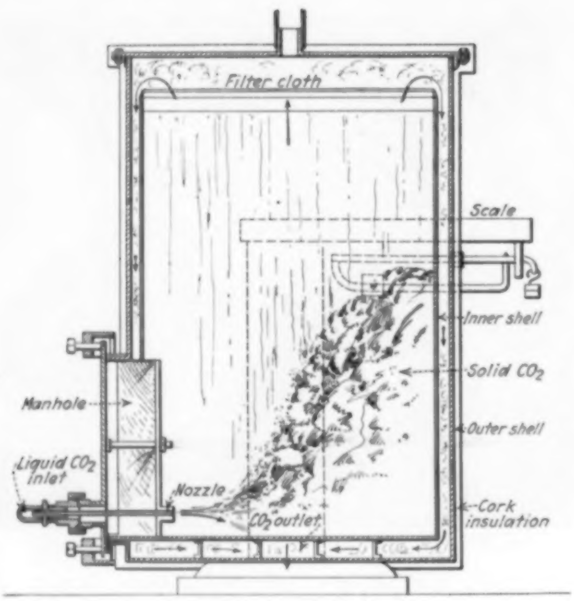


Fig. 3—Early DryIce Snow Tank

375 lb. per sq.in., and produce blocks 20x20x10 in., which are sawed to 10-in. cubes to meet the demands of the current trade, which seems to prefer this size. With the practice now employed this company states that a maximum production of 2,500 lb. per press per hour has been attained, and that various types of solid can be produced by changing control without modifying press construction.

The Frick machine resembles the DryIce machine. It is erected vertically, containing an upper and lower cylinder, both provided with hydraulic compression pistons. The lower cylinder is open at both ends, but one end is provided with a ram which serves for closing the bottom of the cylinder and for compression of the solid CO_2 and ejection from the chamber. The top of this cylinder is closed with a movable head which is held in place by means of the upper piston. The snow chamber is formed in the lower cylinder between the two pistons, which are connected with a rotary pump for operating purposes.

In operation, the lower cylinder is closed at both ends and liquid CO_2 at about 1,100 lb. abs. pressure and stored in steel cylinders, after being cooled, is led into the snow chamber, where it is expanded by means of a special nozzle and timed to run for several minutes. The unsolidified gas leaves the snow chamber on the opposite side. This gas also serves for the cooling of the incoming liquid CO_2. When sufficient solid CO_2 has been formed, depending upon the size of chamber, the liquid supply is shut off and the lower piston raised, whereby the loosely formed solid CO_2 is compressed to a hard block in a square form. The cylinder head is removed by means of the upper piston and the ram ejects solid carbon-dioxide cake. When the lower piston is backed off, the cylinder head is replaced; a new cycle starts with the opening of the liquid CO_2 valve.

While the above processes produce the solid carbon dioxide by the expansion of liquid carbon dioxide and compression of the snow by means of hydraulic pressure, the Carba process (of Swiss origin) omits the use of hydraulic presses. The "converter" is provided with a specially shaped nozzle and two filter cloths, one on top and the other on the bottom. The liquid CO_2 at about 1,100 lb. abs. pressure, is expanded through the nozzle, first below its triple point pressure and then back above the triple point through the construction of the nozzle. A mixture of solid (snow) carbon dioxide containing liquid, also described as wet snow, is collected on the filter cloth placed on the bottom. The surplus gaseous carbon dioxide is reliquefied in a two-stage compressor and is returned to the converter. To prevent the entrainment of solid carbon dioxide and plugging up of the exit line, the converter is provided with a second filter cloth placed on the top before the exit line.

When sufficient wet snow has been collected, just before the end of the cycle, a final charge of liquid CO_2 is admitted to the converter, thereby insuring a complete wetting of the material. Afterward, the exit line of the gaseous carbon dioxide and the liquid line is closed, the bottom valve is opened, and the surplus gas is returned to the gasometer. By lowering the pressure rapidly, the temperature in the converter is lowered also, whereby the liquid adhering to the solid CO_2 solidifies into one solid block. When the cycle is complete, the bottom of the converter is opened and the solid carbon dioxide removed. Uniformity of product depends upon a close control of pressures and of flow, and it is known that production per machine per hour is considerably smaller than from the presses described above. In Fig. 5 is the general arrangement, consisting of a two- and a three-stage compressor, the converter and gasometer, which receives the final gaseous carbon dioxide.

Plant and Product Economics

As pointed out in the previous article in the March, 1931, issue, the cost of liquid CO_2 depends a great deal upon factors such as raw material, fuel, and power. For the production of solid carbon dioxide, less labor is required than for the liquid plant, as the draining, cleaning, painting of cylinders, and valve repairs are not required. The information given by Jones in his talk before the Compressed Gas Manufacturers' Association, January, 1931, covers fully one of the most contested questions, manufacturing costs.

Owing to the newness of this industry, which might incur the necessity of moving plants from place to place,

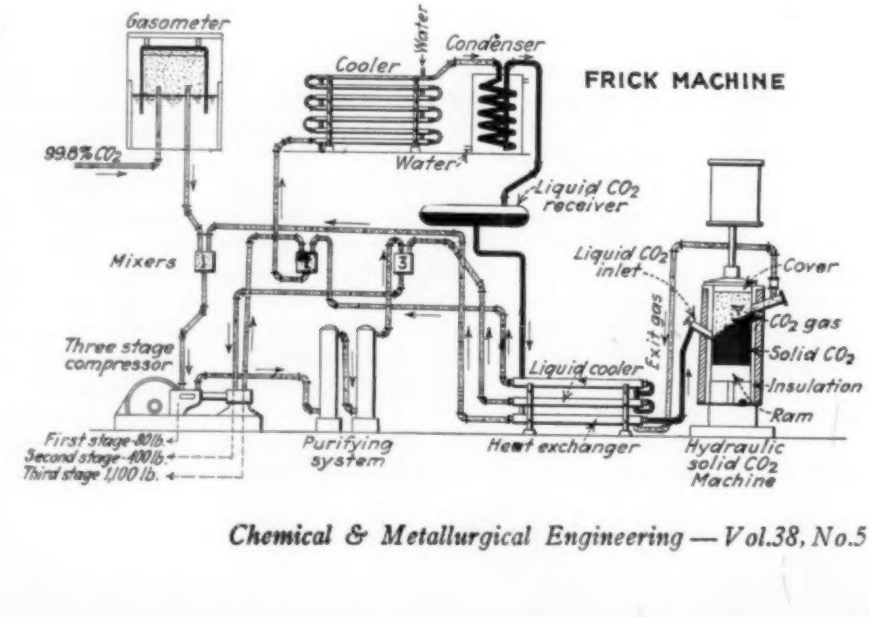


Fig. 4—Diagrammatic Scheme of Solid CO_2 Manufacture by Frick Machine

or even sometimes temporarily discontinuing production, the hazards of excessive capital cost at low production rates are considerable. Fig. 6 shows a typical relationship between capital charges and sales volume, in which 15 per cent has been taken to represent compression and the solid CO_2 machine and its appurtenances are not included.

In my previous article, reference was also made to the necessity of giving due consideration to the source of carbon dioxide, as an absorption system requires a great deal of power, an important factor. Thus, it can be seen from the figures given by Jones that the DryIce Corp. requires an average of 1 kw.-hr. per 8 lb. of solid CO_2, while in the Niagara Falls (N. Y.) plant they produce 13 lb. per kilowatt-hour, and the average power cost per ton is approximately $1. To this must be added $1.40 per ton for depreciation, fixed charges, and maintenance on the compression and solidifying equipment. In isolated instances, such as natural CO_2 gas, the plant investment and power cost may be lower, owing to a higher purity and greater pressure of the gas, but this may be offset by the loss of finished product through sublimation in transit. For coke plants, we require from $8,000 to $15,000, while some byproduct plants represent an investment of from $2,000 to $4,500 per ton of daily capacity.

For almost five years the price of solid carbon dioxide was maintained at 5c. per pound. However, with the increase of consumption and greater economies made in its production, also the decrease in loss during storage and transportation, manufacturers were gradually able to reduce the price to 4.5c. a pound in 1930, while this year, in some localities it is being sold for 3c. a pound. The future trend of prices is very uncertain, but almost surely downward.

As the consumption of ice is seasonal, large storage space is required to meet all peak demands. The solid CO_2 industry is confronted with the same problem; however, any loss in material, as it was of greater value than water ice, had to be minimized by new methods. A novel method is represented by the storage regenerator. This storage regenerator has a capacity of 6,000,000 lb. of solid CO_2, which was filled from February to April and its content sold from May to August, 1930. It is called a regenerator, as the gaseous CO_2 given off during the storage may be returned to the liquid CO_2 plant and recovered in the usual way. Other manufacturers store only for a brief period, in well-insulated chambers.

The principal problem of the industry to date has by no means been the technology, but rather the struggle

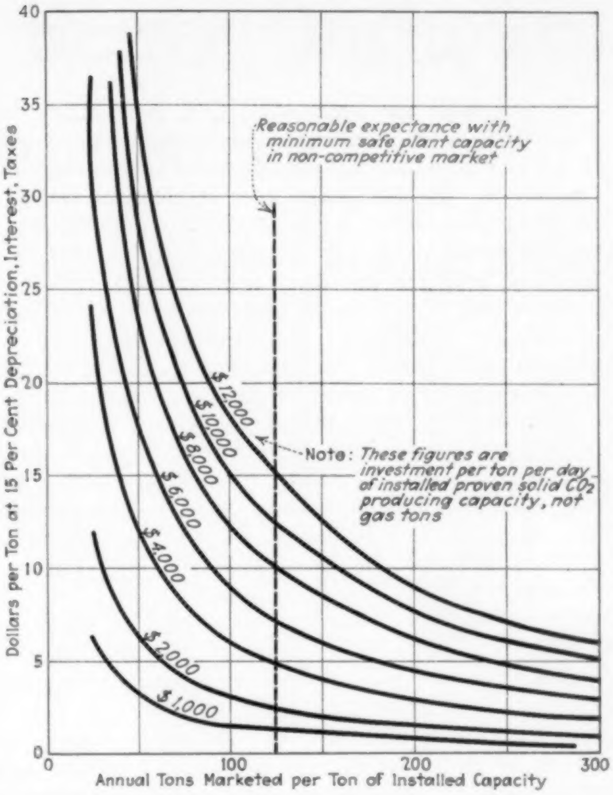


Fig. 6—Per Ton Capital Costs of Process Equipment for Delivering Pure CO_2 to Compressor Suction

to develop sound markets large enough to support manufacture on an economical scale. The distribution problem is further complicated by evaporation loss, which levies a tax of considerable proportions against all other costs. Since the product can be adopted for new uses only after the necessary equipment has been purchased and the necessary methods have been adapted to local conditions, a brake is applied to development of new business which effectively prevents very rapid development of new tonnage markets.

Development of Applications

For transportation purposes, either a new type of container or special arrangements had to be made for utilizing gaseous cold CO_2, whose heat conductivity is 40 per cent less than that of air and produced to the amount of 8.5 cu.ft. per lb. of solid. The three methods of utilizing solid CO_2 are in carloads, trucks, and nonreturnable containers.

That the present method of ice refrigeration is not the ideal way cannot be denied. A railway refrigerator car carries 8,000-11,000 lb. of ice and on a run from the Pacific to the Atlantic coast has to be re-iced at least twice, requiring a total of about 18,000 lb., which is a non-paying load. It also requires almost one-tenth of the car's cubic contents; its replacement, therefore, with a more efficient refrigerant is desirable; consequently, extensive experiments are being made with electric refrigeration and silica gel. The solid-CO_2 manufacturer, after a great deal

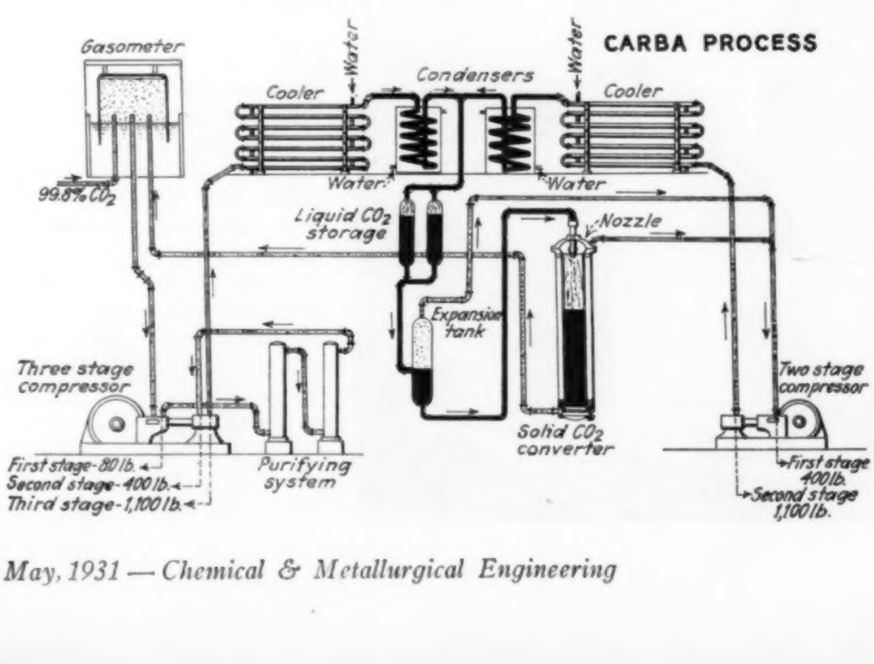


Fig. 5—Solid CO_2 Manufacture Without Hydraulic Presses by Carba Process

of success with smaller vehicles, also carried on extensive experiments, and, after many years, his effort has not been in vain.

A refrigerator car using solid CO_2 is insulated with a 7-in. "Dry-Zero" insulation, and in order to reduce the loss of gas as much as possible, the outer steel shell is gas-proof. Its advantage over mechanical refrigeration is the absence of mechanical parts and the use of unskilled labor. One car is charged with 3,000 lb. of solid CO_2, sufficient for from 6 to 15 days. Placed in the upper end of the car in gas-tight bunkers, it makes the whole car available for the shipment of goods. The gas given off is evenly distributed and an even temperature is maintained by means of dampers on the gas bunkers controlled by thermostatic regulators. In a well-designed refrigerator car, the difference between the top and bottom is close to 3 deg. F. and the average cost, based upon the present market price, is approximately $12 a day. Until a well-organized distributing system could be established, the use of solid CO_2 for refrigerator cars was very much limited. Now that there are many plants strategically located, it is a question of cost of replacing refrigerator car equipment and railroad policy.

Quicker success was attained with trucks refrigerated with solid CO_2 as in the photograph below. The ice-cream manufacturers took the lead in its exploitation and one of the large ones estimates an average saving for him of $250,000 a month. A 500-gal. ice-cream truck requires, under regular conditions, 1,300 lb. of ice and salt, with a body weight of 3,000 lb., while with solid carbon dioxide 150 lb. of the refrigerant and a body weight of 2,200 lb. is required, a reduction of over 45 per cent in weight. Another advantage of solid CO_2 over brine refrigeration is in the absence of corrosion and the waterlogging of insulation, thereby keeping the truck in cleaner and better condition and, consequently, reducing repainting and reinsulating expenses. The temperature stays within 2 deg. F.

The use of solid CO_2 also caused an innovation in the non-returnable shipping containers. For instance, 5 gal. of ice cream in a shipment required a large wooden tub provided with a heavy galvanized iron container, cooled with ice and salt, representing an average weight of 135 lb. The container and wooden tubs were returnable. Now, ice cream is packed in tinned lightweight containers, placed in cartons, is iced with solid CO_2, and weighs only 88 lb. They are non-returnable.

Similar instances are the shipment of meat, fish, etc., where wooden barrels are first given a coat of sodium silicate and then lined with excelsior pads. Afterward a paraffined paper bag is placed inside, a piece of solid carbon dioxide is put on the bottom, and the latter is covered with a wooden rack and a corrugated paper disk and waxed paper. The barrel is filled with meat to within 3½ in., of the upper edge of the barrel, then a corrugated disk and a second piece of solid CO_2 are placed on top. It can hold 180 lb. of the product and requires 10-15 lb. of solid CO_2 per 48 hr., depending on the outside temperature.

Smaller packaging consists of round or square cartons provided with corrugated fiber linings. This lining permits circulation of the gaseous CO_2, which acts as a cooling and insulating medium. The bottom and top of the containers also have corrugated fiber disks. Between them is placed the commodity to be shipped. It is surrounded on the top and bottom with a piece of solid CO_2. Such containers serve mainly for "take-home" commodities.

For transportation, solid CO_2 is wrapped first in heavy paper and placed in either well-insulated trucks or in smaller quantities in balsa wood, or corkboard boxes, shipping jackets, or bags. It is interesting to compare this simple method of transportation with the German practice, such as A. Wultze's whereby solid CO_2 is placed in a container which is surrounded with a freezing mixture of solid CO_2 and ether, capable of maintaining a temperature below —110 deg. F. This is known as Thilorier's mixture and yields a temperature as low as —166 deg. F.

Solid carbon dioxide is marketed under various trade names such as "DryIce," "Carbonice," and "Ice CO_2." Up to the present, 90 per cent of it is being used in the ice-cream industry, 6 per cent for the shipment of meat, 1 per cent in the fish industry, and 3 per cent for various purposes. It serves for the destruction of injurious insects (Laurel Duval, *Food Industries,* p. 541, 1930); in confectionary and shipments of meat (Pan American Petroleum Co. makes shipment of meat in 5-ton lots to its Venezuelan properties); for fire extinguishers; in the manufacture of glass; in oil refining for production of low-freezing lubricating oils; in construction work; bacteriological work; for treating skin diseases; as a preventive of growth of molds and bacteria; in freezing chemicals; in horticulture; for testing varnishes; and for removing friction-generated heat during the kneading of bread.

The market price of solid CO_2 is already under half that of liquid and if we consider that for every pound of liquid CO_2 furnished an additional 2 lb. of steel containers must be handled, which require a heavy cost of distribution per pound of liquid CO_2, heavy investment, and high cost of upkeep, interesting possibilities of the application of solid carbon dioxide for many purposes would seem to be presented.

Packing Special Truck With Solid CO_2

Helping to Make Better Business In Process Industries

A CROSS-SECTIONAL view of the present thinking of those who manage American industry shows some very interesting trends, as well as differences, of opinion. Since these executives and engineers are largely responsible for the conduct of business, their views, whether right or wrong, will affect the immediate future of both the worker and the investor in all walks of life. These opinions of management have been recorded in the discussion of "A Platform for American Business," presented in twenty-two McGraw-Hill publications during the month of March. Advance copies were sent to four thousand men at the head of almost as many companies, large and small, and including the most distinguished leaders of the business world. In letters from one to five pages, eight hundred of them commented on the principles embodied in the platform. With all their diversity of interest and variety of opinion, their combined judgment has expressed so definite an attitude that it is entitled to consideration by chemical engineers and executives of the process industries.

Naturally, so large a mass of correspondence presents a difficult problem in analysis. But out of it has come some distinct impressions, clearly stated by individuals and supported by a preponderance of testimony. Extracts from several letters of chief interest to chemical engineers and managements of the process industries are published here in some detail. Perhaps the others can best be pictured by breaking down the mass reactions into the major themes that have been most discussed because they were considered most important.

Living Standards and Unemployment—No single issue received as much earnest thought as the broad problem of the social responsibility of industry. There seemed to be almost universal acceptance of the statement that if American business does not develop a more effective system of self-government in this matter, it can well look for an extension of state and federal control. The history of legislation on workmen's compensation was often cited as a direct parallel of what may be expected in the case of unemployment insurance. As one chemical engineer very well said: "We take depreciation on buildings and process equipment, but none on labor. We must have a labor depreciation account—call it old-age insurance or employment reserve, it is the same thing. This sounds like socialism, but it is coming."

Business Stabilization—There apparently is no lack of crystallized opinion in the minds of business men as to the necessity for organizing definite means and measures for stabilizing business progress. The heart of the difficulty lies in the present lack of control over preventable inflation and deflation, and here the finger is pointed straight at the banker, whose function it is to exercise a restraining influence over industry. So far, he has failed to do so. However, better and longer term planning of business operations, particularly in research, are necessary if industry sets its own house in order.

Cooperative Effort—So complex are the interrelationships between the units of an industry today and between whole industries as well, that any broad program of planning must involve cooperation, coordination, and control. But since this bears directly upon certain national laws regulating the freedom of private initiative, it is not surprising that there should be a remarkable difference of opinion among these commentators. On the whole it is generally recognized, however, that the prevailing anti-trust laws need revision where in themselves they have created evils by interfering with constructive coordination and inducing destructive forms of competition. This is strongly emphasized in at least one of the letters that follow.

Constructive Competition Will Stimulate Business

By F. W. KELLEY
President, North American Cement Corp. Albany, N. Y.

SCIENCE and intelligent planning have provided means which, unsocially used by the individual in the delicate balance of modern industry, destroy the careful planning of many wise men. The present social organism, of which industry is a most important part, requires sounder economic knowledge and practice than that of many men in business. Most men work and will continue to work for their selfish advantage. That is right and desirable, but we must try to prevent the individual from doing what he believes to be for his selfish advantage, things that ultimately hurt him and seriously hurt his fellows.

We need sounder education in economic fundamentals, but we also need a restudy of what we call individual initiative or individual freedom as applied to business and industry. We have had this study in primitive personal relations from the start of civilization. As individuals lived together in larger and larger interdependent groups, legalized murder was curtailed to the individual, next to the tribe, next to the city, until now it exists only to the nation, and then under certain well defined limits as to methods. In business, however, within ten years United States Government representatives have urged that competition in business demanded lying and misinformation, to the end that one competitor might more easily murder the other in a business way, on the theory that the public was thereby benefited. The Supreme Court has partially limited these extreme views, but I believe much remains to be done.

All thinkers must agree that proper competition in most businesses is desirable to insure to the public maxi-

mum enterprise on the part of producers and marketers in seeking and producing the best quality of product at the lowest price consistent with the quality. But the time has come to require that competitors limit their methods and practices to what would be workable and for the general good if used by all. At the present time many practices that would not fill this specification are legal and widely used in the industries.

Unrestrained, ignorant selfishness is at the bottom of most of our present troubles, and the real selfish interests of each and of all require that the economically ignorant use of individual freedom in industry be restrained where it clearly hurts the pursuit of happiness of most others. Liberty of action must not become license to do nearly anything.

Technical Progress Demands Coordinated Effort

By WALTER A. SCHMIDT

President, Western Precipitation Co., Los Angeles, Calif.

APPARENTLY the trend of progress must be determined by swinging back and forth between the opposing conditions of maladjustment, which we call periods of prosperity and depression. In the absence of an absolute rule or infallible guidance, this probably cannot be avoided. The seriousness of the condition arises from the fact that we, as individuals, refuse to act in such manner that these fluctuations can be brought within limits which will permit the ship of industry to proceed on a smooth voyage, insuring safety to all passengers aboard.

The factors which enter into and cause instability in our industrial machine are not difficult to discern, although they are difficult to control. So long as our production capacity was small and the principal requirements of our civilization were the mere necessities of life, we could blunder along with an assurance that conditions would right themselves either through increasing or decreasing production after the need thereof was firmly established by a depleted or glutted market. But, technical progress of the past few decades has established a mode of living that cannot stand the strains of extreme fluctuation. We are too dependent upon the markets for luxuries and non-essentials. Furthermore, there now seems to be no limit to what we can produce, and new factors are constantly coming into play. It is safe to say that our technical progress has far outstripped our social adjustment, and that extreme individualism must be replaced by some system of coordinated effort. This is most needed in chemical industry.

As stated in the McGraw-Hill Platform for American Business, "New conditions of our modern industrial civilization have laid new social responsibilities upon those men who guide the destinies of business enterprise." It appears almost axiomatic that we must coordinate production and demand, that we must insure steady employment and good wages to workers, and that we must maintain price levels which will insure profitable operation to industrial enterprises. At the same time, we must avoid governmental regulation or control beyond the point necessary to "keep clear the field of economic activity for private business initiative and to assure a basis of fair and equal competition in domestic and foreign trade." In establishing a coordination of effort for the dual purpose of insuring a proper distribution of markets to producers and a proper distribution of labor to workers, we also must guard against the establishment of an artificial structure which would stunt technical progress or discourage personal initiative, and which would not provide for the sloughing off of methods and equipment which are out of date.

Opinions naturally will differ as to how this shall all be brought about without destroying our American ideals of personal independence, and many mistakes undoubtedly will be made in working out a proper code of procedure, but we cannot start too soon to put our house in order. The McGraw-Hill Platform for American Business clearly sets forth the more important aims which shall be achieved as rapidly as possible. It is indeed a hopeful sign that so many of our technical and non-technical publications are giving so liberally of their space to establish a consciousness among our people that in our present struggle for a return to prosperity we have before us a problem of fundamental importance and of far-reaching effect, calling for clear unbiased thinking and for courageous action.

Chemical Industry Must Develop New Marketing Methods

By C. R. DOWNS

Weiss & Downs, Inc. New York City

RESEARCH and development are generally understressed in developing greater tonnage markets and new uses for products already made by reasonably efficient processes and equipment. Particularly is this true in chemical industries, in which very often large sums of money are expended in developing new processes requiring new equipment in order to obtain a few per cent greater yield. The old equipment, we will assume, is largely written off and the earning power of new capital for new equipment cannot be justified by the slight increase in efficiency obtained thereby. Process improvement should not be neglected, but the development of new uses should be emphasized more than at present. In many cases where we already have installed capacity far in excess of the known market, it would be most logical to find new outlets for the product. Certainly process improvement here cannot be as remunerative as greater product consumption. This sounds like a statement of the obvious, but research on the development of new uses is still too often neglected.

Chemical industry, in the writer's opinion, should sell more products under a brand name, both on a tonnage basis and in smaller packages,

and these should be sold by the most direct line to the customer. Chemicals to be used in the manufacture of other materials, of course, do not reach the ultimate consumer, and here the brand name is perhaps less important, since the products usually are bought on a price-quality basis. If the chemical manufacturer sells only to another manufacturer, who in turn disposes of his product to other successive hands, the chemical manufacturer is far removed from the buying trend of the ultimate consumer.

Inventories are likely to pile up all along these series. Consequently, chemical industries feel the depression long after it starts and likewise are delayed too long on the pick-up in consumer purchases. They get the signal too late as the industry is not integrated. If, however, the chemical manufacturer packaged at least a portion of his product for ultimate consumer use, which is possible with many chemical products, he would be able to judge public purchasing power more accurately. The automobile industry is a good example of proper integration and the petroleum industry is working in that direction. Here brand names are of great importance. There have been dismal failures of chemical manufacturers who have attempted this, but the failure many times lay in a sales department that did not know how to package a product and advertise it to the ultimate consumer.

An International Viewpoint For American Business

By ARTHUR WRIGHT

President, Filtration Engineers, Inc., Newark, N. J.

IS IT not true that international business is founded on the policy of "live and let live"? When we Americans fail to acknowledge that elsewhere than in the United States potash can be economically produced, sugar and other useful materials more cheaply obtained, how can we hope to find other countries interested in buying our goods? Our present tariff has gone far beyond the idea of protecting us, and is in reality a dam preventing the flow of good business both for us in the United States and for those in other countries. As manufacturers of chemical engineering equipment we are subject to the competition of foreign products, but as long as we have ingenuity and enterprise, we have no need for excessive tariff protection. We find, for instance, that the cost of some of our products made in Germany is only about 25 per cent less than our own cost, and in some designs it is even higher.

The United States is blessed with higher standards of living than any other country in the world, but in my travels abroad I have observed that human nature is no different there from here, and that there is a very positive determination on the part of the working people everywhere to raise their own standards of living. It is true that they have not yet succeeded to the extent we have in the United States, as, for instance, in a plant I visited in Czecho-Slovakia. There I found that women with bare feet were operating plate and frame filter presses starting in at 7 o'clock at night to operate until 7 o'clock in the morning in a room that was dimly lighted, the floors of which were wet and cold, and the products giving off considerable hydrogen sulphide. They would get for their weekly efforts just $5. That is certainly not a standard that can long exist in any plant or in any country. In reality that plant had a high cost of manufacture, even with this low wage rate for woman labor, working the night shift. Continuous and automatic units would change the cost of the manufacture of that product, enabling the manufacturer to enjoy a far greater profit, which in turn would enable him to pay a higher wage to those who still would be employed in the plant.

Another factor of importance emphasized in the McGraw-Hill platform is the development of codes of practice in the various industries. I know that the equipment manufacturers could very well and profitably cooperate in firmly fixing such a code for their business. At the present time, in the effort to get business, many of the manufacturers are encroaching upon the prerogatives of other branches of the industry, as, for example, the work of the consulting engineer. This is not economic and contributes its little part to the difficulties we have encountered during this depression. Again the idea that an order must be obtained at any cost, so that three or four prices are given to the prospect, may result in finally obtaining the order, but certainly not the profit.

Rayon Industry Needs Long-Term Planning

By DONALD I. GROSS

Chemical Engineer, Newton Center, Mass.

THE DEPRESSION is commonly blamed on overproduction. To a certain extent this is true, but how many people realize how much of the responsibility rests with the producer? Lack of foresight in industrial expansion is glaringly illustrated by a look at the development of almost any chemical industry, taken as a whole, during the last two years.

The writer has been connected with both the paper and the rayon industries for the last ten years, and has been forced to a realization of the serious consequences of this development. The rayon industry, for example, grew with extreme rapidity until recently hit so hard by frequent and drastic price reductions. There was and still is business enough for all of the 14 or 15 manufacturers in the United States, but the desire on the part of a few to monopolize the entire demand has led to one price reduction after another, with production increasing at such a rate that the demand has not been able to keep up with the supply.

Had those responsible given consideration to the inevitable result of such tactics, there would not be quite the depression in this industry there is today, even taking into consideration the fact that there were other factors not intimately connected with their operations or beyond their control which have all added to the present state of affairs. The larger percentage of the rayon manufacturers, particularly the smaller ones, are operating today at or below cost, and are unable to lower their cost by increasing their production schedule, because of lack of capital and lack of public confidence in the industry. Not only is the public paying for such short-sightedness and selfish competition but the manufacturers as well.

Chemical Engineering As a Career

By JOHN C. OLSEN

Professor of Chemical Engineering, The Polytechnic Institute, Brooklyn, N. Y.

EDITOR'S NOTE: *Many young men will soon be leaving the colleges and universities to begin their careers in chemical engineering. Under normal business conditions, they might have chosen the particular industries in which they preferred to work. Today, many are not that fortunate. To those who face the problem of finding a job, the following extracts from the talk which Prof. Olsen gave in the recent student course at the Chemical Exposition in New York will be of special interest. The whole of his address is to appear shortly in the* JOURNAL OF CHEMICAL EDUCATION.

THE chemical engineer's principal contribution in the fields of industry is in production. He may design and construct a plant, but most of his time is devoted to operation. Therefore a great many of the chemical engineers in industry today have titles of supervisors, department heads, plant superintendents, production managers, and the like. There was a time when the chemical engineer's only entrance to the production organization was through the laboratory. Today many, if not most, men enter as cadet engineers, shift supervisors, assistant foremen, and the like. There is no royal road to success for the chemical engineer, but because the production man "makes the wheels go round," he becomes a most essential part of industry and his opportunity for advancement to executive responsibility is correspondingly large.

The work of the chemical engineer in developing processes is of very great importance. In many of the larger and more integrated industrial organizations, there is a distinct division of work between the research chemist on the one hand and the research engineer and development man on the other. The chemist commonly conceives the process and demonstrates it on the laboratory scale. The chemical engineer takes the laboratory process, proves and develops it first in the semi-works, then in the full-scale unit, and finally in the commercial plant. In smaller organizations, chemical engineers are often selected for chemical as well as engineering research. This is primarily because of the flexibility that makes the chemical engineer adaptable to the solution of both chemical and engineering problems.

The opportunity for the chemical engineer in technical research is second only to that in production. His rise may be equally as rapid, despite the fact that research, unfortunately, is not universally recognized as an indispensable department of all industry. And not until research is planned on a long-term basis, with a definite financial reserve set-up to take care of it, will the research organization have the same security and stability that is found in production work.

Another very important part of the work of the chemical engineer is in the field of economics. Just as industry succeeds only as it makes a profit, so the chemical engineer is vitally concerned with the economic bases of industrial operations. Before a process from the research laboratory can be translated into successful commercial production, someone must carefully study its economic feasibility—its primary utility as compared with existing processes and practices. This gives rise to a great and growing opportunity for the chemical engineer. Likewise, the same methods are applied to the study of industries themselves—by chemical engineering advisors for investment trusts, banking houses, and insurance companies.

Because the market for the product of a chemical engineering process determines its success or failure, the chemical engineer is often called upon to study chemical —as contrasted with chemical engineering—economics. He must know the methods and principles of market analysis, costs and prices, studies, tariff and freight rates, and many other factors that in their aggregate have come to be known as the field of commercial research. This field is relatively new, but is growing rapidly, especially as the business depression has put a premium on the more scientific aspects of industrial marketing.

These opportunities for the chemical engineer in industry all lead eventually into executive work for the man who is willing to take over the responsibilities of direction and supervision. And because the engineer has been trained to get his facts and base his conclusions and action on such data, rather than on guess-work or hunches, he is most often successful, particularly in a technical enterprise. We must not forget, too, that these process industries, with their constantly changing technology, require a better appreciation of the intimate technical detail and possibilities of the job and of the industry as a whole. Hence the increasing number of so-called "technical executives."

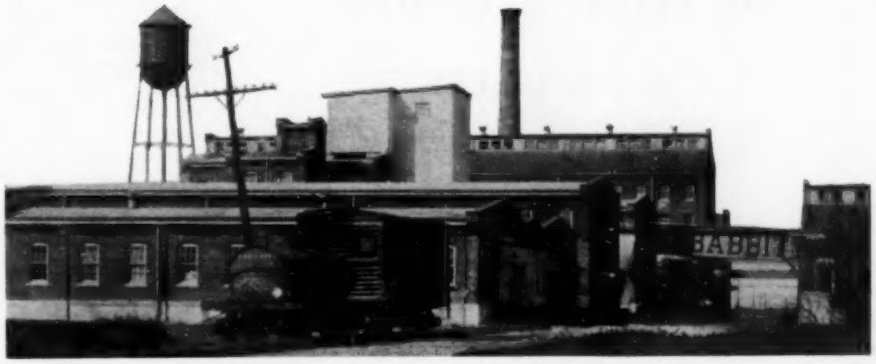
A LIMITED number of chemical engineers must be engaged in teaching this subject in the institutions which offer courses in this subject. As chemical engineering requires a knowledge of both scientific principles and plant practice, it is essential that the men who teach this subject should have had a number of years of practical experience in plant design or operation before undertaking the teaching of this subject. Most professors of chemical engineering also have the opportunity of practicing their profession as consultants in some branch of chemical engineering. This work seems to keep the professor abreast of the most recent progress in the subject which he teaches and also serves as a very desirable supplement to his academic salary, which is not always adequate. However, the eminently practical character of chemical engineering education calls for high-grade men, and in most institutions, salaries are correspondingly high.

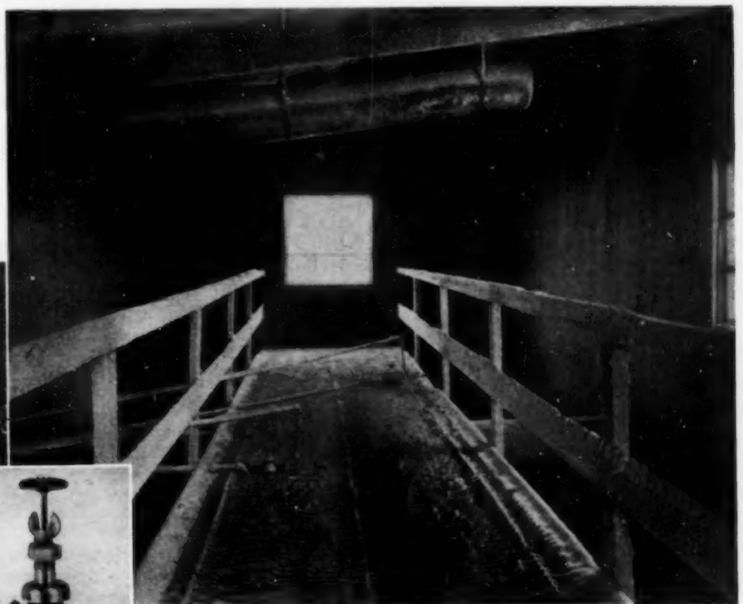
The compensation received by the chemical engineer is comparable with that received by engineers in other fields doing work of corresponding importance or occupying positions of equal responsibility. The initial annual salary of the young man graduating from the usual four-year course will be from $1,500 to $1,800. The graduate with a Master's degree will receive a somewhat larger compensation, ranging from $2,000 to $2,400, while the man having a Doctor's degree will receive from $2,400 to $3,000. In from five to seven years this compensation is usually doubled.

Under normal business conditions it is frequently possible for the young chemical engineer to choose the industry in which he prefers to work. In spite of the high state of efficiency to which many of the chemical industries have been brought, most of them still offer many opportunities for further development and improvement by the chemical engineer.

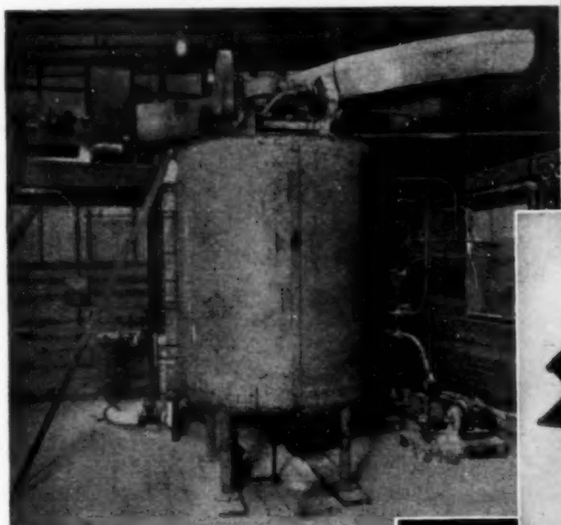
Blowing Fluid Soap Into Dry Soap Powder

Soap powder has long been popular for various cleansing operations, but only in the last few years have modern production methods overtaken the more cumbersome traditional procedures. A process described by Oscar H. Wurster in the April issue of *Chem. & Met.* is now illustrated here from an installation made at the Armour Soap Works. The white structures in the center of the plant view (on the right) are the towers inclosing the operation, shown in the detail in the other illustrations below. In essence the process involves spraying a hot mixture of soap, soda ash, and water into an air-cooled tower, the moisture disappearing in the crystallization of the soda ash as it drops.





Interior of the top of spray tower, where nozzles eject the hot fluid downward



Pump room adjacent to spray tower, which supplies hot soap and circulating air

Center—Nozzle developed by Wurster & Sanger, Inc., for spraying soap powder

Bottom of spray tower where powder drops on moving belt and is discharged into receivers at left

Volume Relations of Gases At High Pressures

By J. R. DILLEY

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ALTHOUGH it has long been recognized that the ideal gas law ($pv = RT$) is an approximation even at moderate pressures, until recently practice has been to employ it for most computations. For most engineering purposes this may have been sufficiently accurate, as errors from this source were small within the usual working range. However, with the advent of processes where gases are used at pressures as high as 1,000 atmospheres (14,700 lb. per square inch) and temperatures to 600 deg. C. (1,112 deg. F.), the marked deviation of actual gases from the law of the ideal gas cannot be ignored. For example, when nitrogen is compressed at 20 deg. C. from 1 atm. to a pressure 1,000 times as great, the resultant volume is twice that which the law of the ideal gas predicts.

However, by introducing certain compressibility factors in the solution of a problem involving volumes, temperatures, and pressures of a gas, compensation for the deviation may be made. These factors are different not only for various gases but also depend on the temperature and the pressure. Direct use of available data in calculations is not simple; hence an easy method of accomplishing the result with curves such as those shown in Figs. 1 to 4 is of value.

Four charts are shown, one each for carbon monoxide, nitrogen, hydrogen, and a hydrogen-nitrogen mixture containing (by volume) three parts hydrogen and one part nitrogen. The last is the mixture used for direct synthesis of ammonia. On these charts pressure is plotted against a factor f called "volume relation." The pressure range is from 1 to 1,000 atm. (14.7 to 14,700 lb. per square inch) and the temperature range is from —70 deg. C. to 300 deg. C. (—94 deg. F. to 572 deg. F.). The charts have been prepared from data obtained and published by the Fixed Nitrogen Research Laboratory, U. S. Department of Agriculture. (See Bartlett, *J. Am. Chem. Soc.*, **49,** 1927, pp. 687, 1955; Bartlett, Cupples, and Tremearne, *ibid.*, **50,** 1928, p. 1275; Bartlett, Hetherington, Kvalnes, and Tremearne, *ibid.*, **52,** 1930, pp. 1364, 1374.)

Although the original charts were plotted on a scale sufficiently large to make accurate readings possible, the volume-relation factors at 1 atm. are so nearly alike that they cannot be distinctly separated. Since these points are important, the exact values at 1 atm. for each temperature curve are tabulated on the chart.

The following problems will illustrate the use of the charts. Pressures and temperatures in other units can readily be converted to atmospheres and degrees Centigrade.

Volume Conversions—Given the volume v_1 of a quantity of gas under one set of conditions, the volume v_2 of this same quantity of gas under a new set of conditions may readily be determined by solving the equation $v_2 = v_1 \times \frac{f_1}{f_2}$. The factors f_1 and f_2 are then obtained from the charts for the several pressures and temperatures in question.

Example I—Given 100 cu.ft. of a mixture of 75 per cent hydrogen and 25 per cent nitrogen at 800 atm. and 25 deg. C.; what is the volume of this mixture at 200 atm. and 300 deg. C.? Here $p_1 = 800$, $t_1 = 25$, $p_2 = 200$, $t_2 = 300$. Using Fig. 1, (1) read vertically on the 800-atm. line to the intersection with the 25-deg. curve, then horizontally to the vertical scale, and obtain factor $f_1 = 465$; (2) read vertically on the 200-atm. line to the intersection with the 300-deg. curve, then horizontally to the vertical scale and obtain factor $f_2 = 88$. Finally, (3) divide factor f_1 by factor f_2 and obtain 5.27. The volume v_2 at 200 atm. and 300 deg. C. will be $100 \times 5.27 = 527$ cu.ft.

Example II—Given 10 cu.ft. of nitrogen at 600 atm. and 100 deg. C.; what is the volume of this gas at 1 atm. and 50 deg. C.? Here $p_1 = 600$, $t_1 = 100$, $p_2 = 1$, $t_2 = 50$. Using Fig. 2, (1) read vertically on the 600-atm. line to its intersection with the 100-deg. curve, then horizontally to the vertical scale and read factor $f_1 = 305$; (2) read from the table the factor f_2 at 1 atm. and 50 deg. C., which is 0.8452. Finally, (3) divide f_1 by f_2 which gives 360.9. Therefore the desired volume v_2 is $10 \times 360.9 = 3{,}609$ cu.ft.

Pressure or Temperature for Given Change in Volume—Given the volume of a quantity of gas under one set of conditions, either the pressure or the temperature required to give a new volume may be determined from the charts. The unknown value of f_2 is obtained by transposing the equation, $v_2 = v_1 \times \frac{f_1}{f_2}$ and solving for f_2; thus, $f_2 = \frac{v_1}{v_2} \times f_1$. After determining f_2 the desired pressure or temperature is obtained from the charts. The method is best shown by an example.

Example III—Given 100 cu.ft. of carbon monoxide at 400 atm. and 200 deg. C.; what pressure is required at a temperature of 25 deg. C. to decrease this volume to 50 cu.ft.? Here $v_1 = 100$, $p_1 = 400$, $t_1 = 200$, $v_2 = 50$, $t_2 = 25$ and p_2 is unknown. Using Fig. 4, (1) read vertically on the 400-atm. line to the intersection of the 200-deg. curve, then horizontally to the vertical scale and obtain $f_1 = 187$. Substituting values in the equation $f_2 = \frac{v_1}{v_2} \times f_1$, we get $f_2 = 374$. (2) Locate the point 374 on the vertical scale, read horizontally to the intersection of the 25-deg. curve, then vertically to the horizontal scale and read desired pressure $p_2 = 625$ atm.

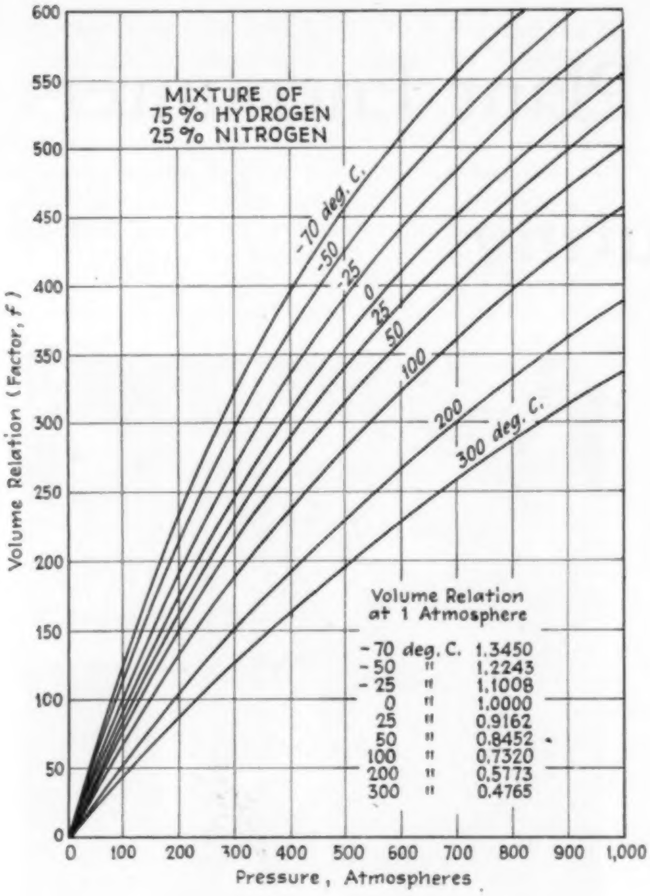
The same method is used for determining an unknown temperature t_2. The value of f_2 is first obtained and then the intersection of the horizontal line drawn from f_2 with the vertical line through the pressure p_2 will determine the desired temperature.

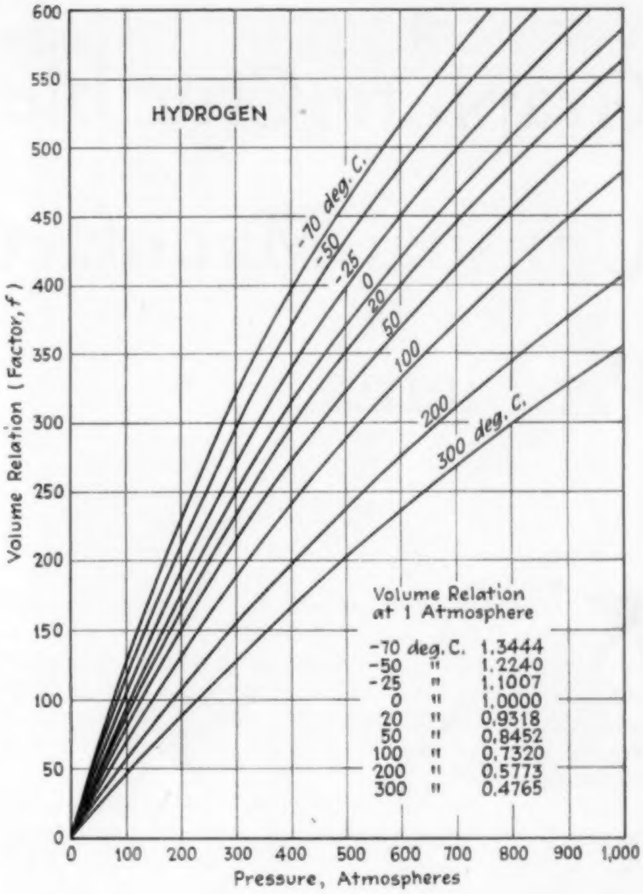
Density of Gas at Any Pressure and Temperature—The density of any of the gases mentioned may be obtained for any pressure, p, and temperature, t, from the expression $D = D_o \times f$, where D is the density at p and t, D_o is the density at standard conditions (1 atm. and 0 deg. C.) and f is the factor at p and t obtained from the curves. For the four gases the densities at 1 atm. and 0 deg. C. are as follows:

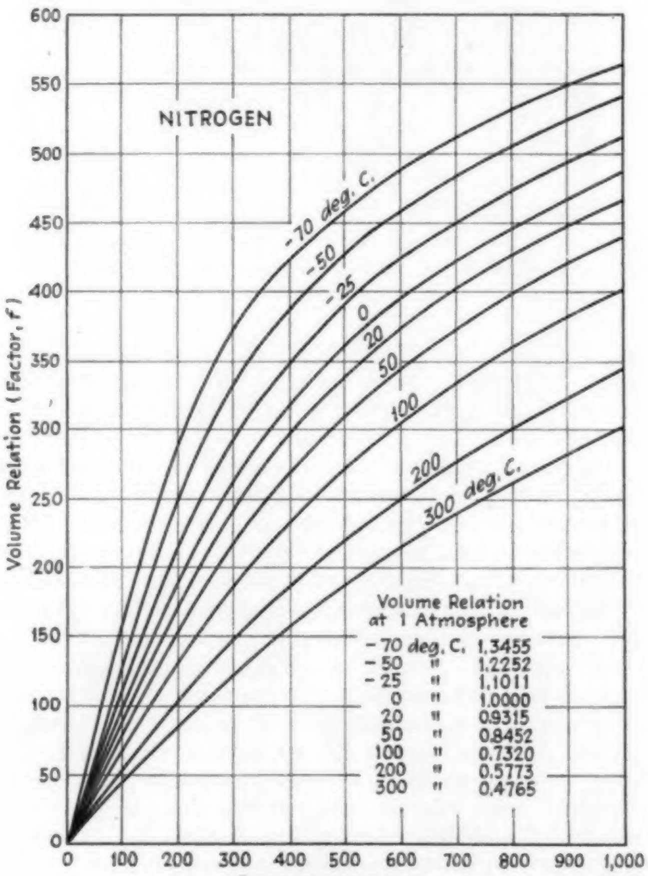
	Density: Grams per Liter	Density: Lb. per Cu.Ft.
Hydrogen	0.0899	0.0056
Nitrogen	1.2506	0.0781
Hydrogen-nitrogen mixture ($3H_2 — 1N_2$)	0.3800	0.0237
Carbon monoxide	1.2504	0.0781

Volume at Standard Conditions—The number of volumes of gas at atmospheric pressure and 0 deg. C. required to give one volume at any other pressure and temperature may be obtained by a direct reading on the chart.

Example IV—How many volumes of nitrogen are required at 1 atm. and 0 deg. C. to give one volume when compressed to 600 atm. at a temperature of 200 deg. C.? Using Fig. 2, read vertically on the 600-atm. line to its intersection with the 200-deg. curve, then horizontally to the vertical scale, and read 250. This means that 250 cu.ft. of nitrogen is required at 1 atm. and 0 deg. C. to obtain 1 cu.ft. at 600 atm. and 200 deg. C.; or conversely 1 cu.ft. at atmospheric pressure and 0 deg. C. will be 1/250 cu.ft. when compressed to 600 atm. at 200 deg. C.







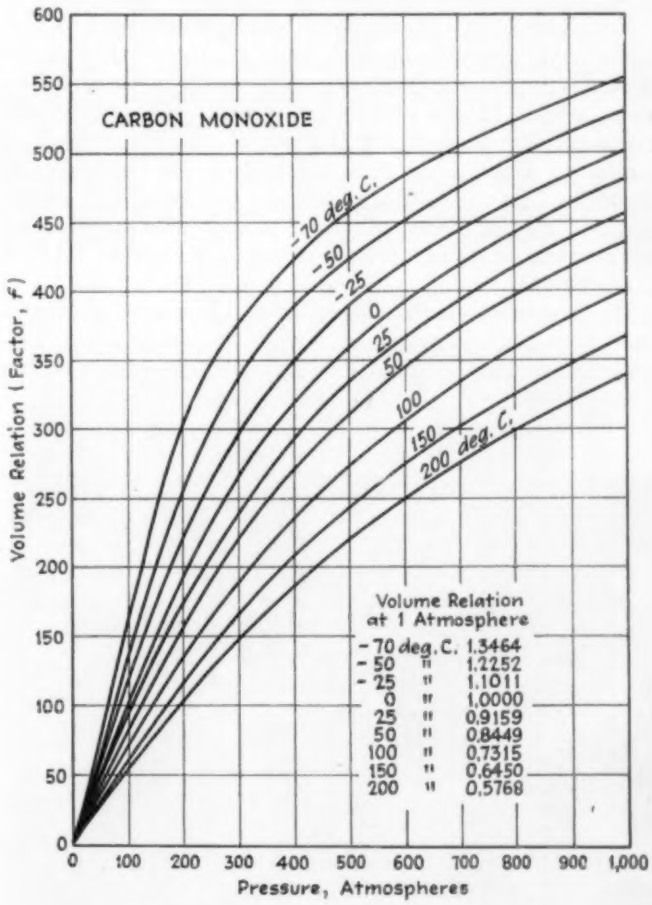


Fig. 1—Volume Relations of 75 Per Cent Hydrogen—25 Per Cent Nitrogen Mixture

Fig. 2—Volume Relations of Nitrogen at High Pressure

Fig. 3—Volume Relations of Hydrogen at High Pressure

Fig. 4—Volume Relations of Carbon Monoxide at High Pressure

Graphite Crucible Plant Encounters Unusual Manufacturing Problems

NEW JERSEY is one of the leading ceramic producing districts in the United States; and Trenton, its capital, is likewise the capital of the state's ceramic industry. It is an important center for sanitary ware, pottery and tableware, building and decorative ceramic products and, in addition, of refractories and graphite crucibles.

The plant of the Bartley Crucible & Refractories Company at Trenton has a number of interesting and somewhat unusual features that merit description. This plant, reported to be the largest in the country engaged principally in making graphite crucibles, was founded 22 years ago under the name of Jonathan Bartley Crucible Company. After a period devoted exclusively to crucible manufacture, industrial demands made necessary the enlargement of the production scope to include special crucibles for high-temperature and rapid-melting furnaces, as well as furnce refractories for non-crucible furnaces. In addition, the company produces both standard and special shapes in silicon-carbide, silica, and magnesia refractories to meet the needs of general refractory requirements.

As graphite crucible manufacture is the more novel branch of the company's activities, the article which follows will be limited to its description. Graphite crucibles

Fig. 1—Paddle Mixers for Blending Clays and Graphite for Crucible Manufacture

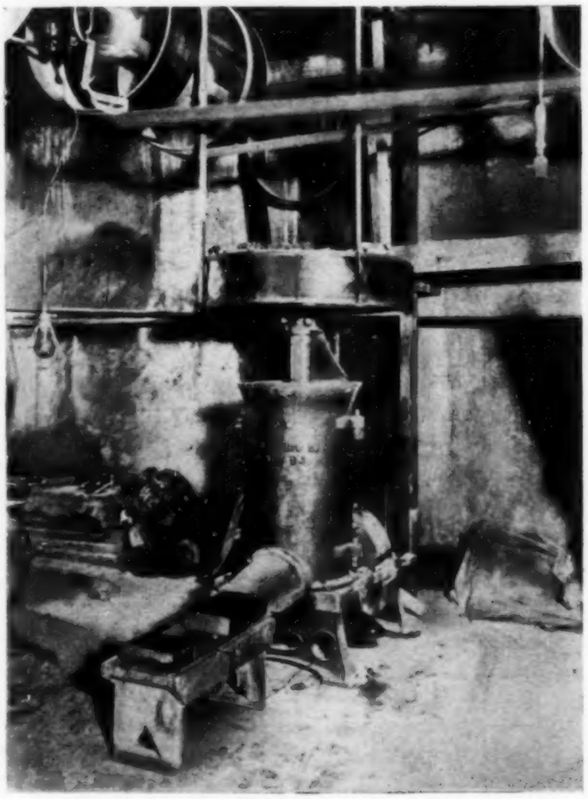


Fig. 2—This Pug Mill Compacts the Blend and Extrudes a Continuous Bar of Material Which Is Cut Into Chunks

are used very extensively in foundry work and in the alloy steel and non-ferrous alloy industries, as well as in the smelting and refining of such metals as copper and zinc, and of precious metals.

Foliated graphite, as a component of crucible mixtures, has a number of functions including the mechanical one of preventing any general fluxing of the crucible at high temperature. As graphite is a good conductor of heat, it improves heat transfer, minimizes danger of breakage from heating and cooling strains, and reduces the coefficient of expansion within the crucible wall.

Two forms of graphite occur in nature; the amorphous type, widely disseminated; and the foliated variety, most of which is found in Ceylon. This island has been described as a producer of 25 per cent of the world's graphite tonnage, and 80 per cent of the value. The Bartley company uses only the foliated variety, which is combined at the plant with mixtures of clays, both domestic and imported, and is worked up into crucibles and certain refractory shapes.

At present the plant consists of two factory units, practically identical in construction and layout, one of which contains the research laboratory and equipment for refractory manufacturing, and the other, the plant

for graphite crucibles and various special graphite shapes.

Raw materials—clays and graphite—are received at the plant's own railroad siding and are unloaded under cover to a heated curing house where the containers are stacked on grids to permit air circulation. After this treatment, material is ready for grinding and blending. Mixtures suitable for various purposes have been carefully worked out and are used as a basis for all products. Prior to blending, the materials are stored in mixing rooms, later to be weighed into blending tanks. Here the necessary water is added and the mixture is dropped in accurately weighed batches to heavy paddle-agitated mixers (Fig. 1) where it is thoroughly blended for a prescribed period. After blending, the mixture is conveyed to the pug mill shown in Fig. 2, which serves to compact the blend into easily handled chunks. The chunks are loaded on trucks and run into a sweat room, where the clay is aged under moderately high and constant temperature, and high humidity. This operation increases the colloidal content of the clay through bacterial action, and improves its bonding power and plasticity. Sweating ordinarily takes about one month.

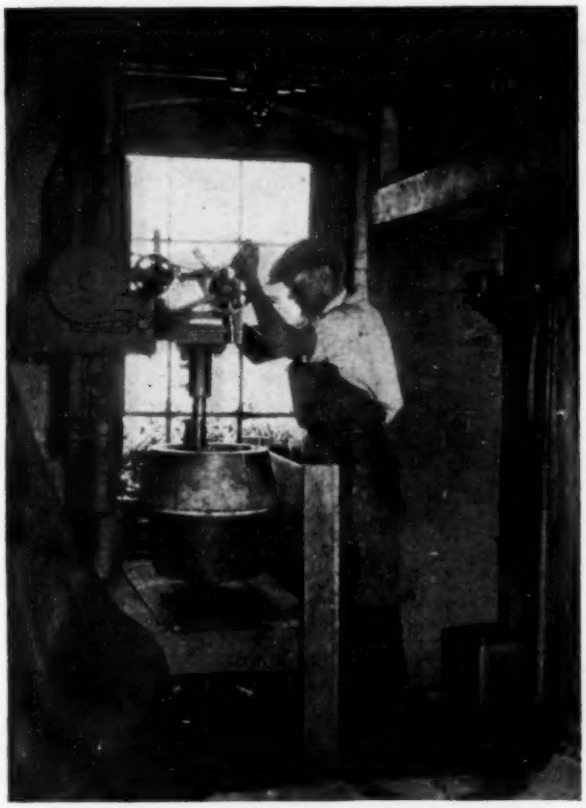


Fig. 3—"Jiggerman" Forming Crucible Within a Mold; Note Spindle Supporting Jigger Blade

Formation of the crucibles is the next step and one which requires a high degree of skill on the part of the "jiggerman," or operator. For this operation the plant has on hand a very large number and variety of plaster-of-paris molds, each so constructed that its inner surface corresponds to the required outside dimensions of one of the many shapes and sizes of crucible made in the plant. In use, the halves of a mold are mounted on the table of a specially designed machine known as a "jigger." As is evident from Fig. 3, this machine consists of a vertical spindle carrying a plow-like blade, supported so that the blade can be raised or lowered or moved into any position. The shape of the blade used depends on the desired inner contour of the crucible to be made. With the mold in place, the blade is lowered through the open top and set in rotation. Then chunks of the moist clay-graphite mixture are dropped in front of the rotating jigger blade, which plasters the material inside the mold.

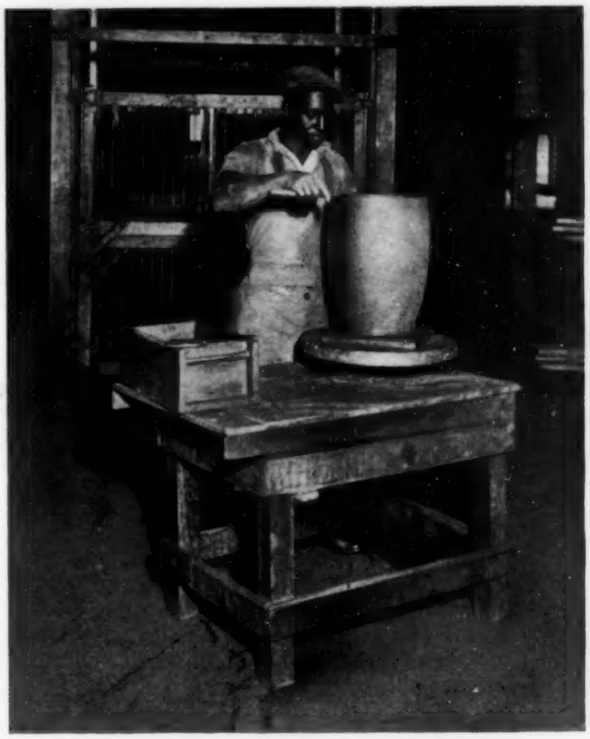
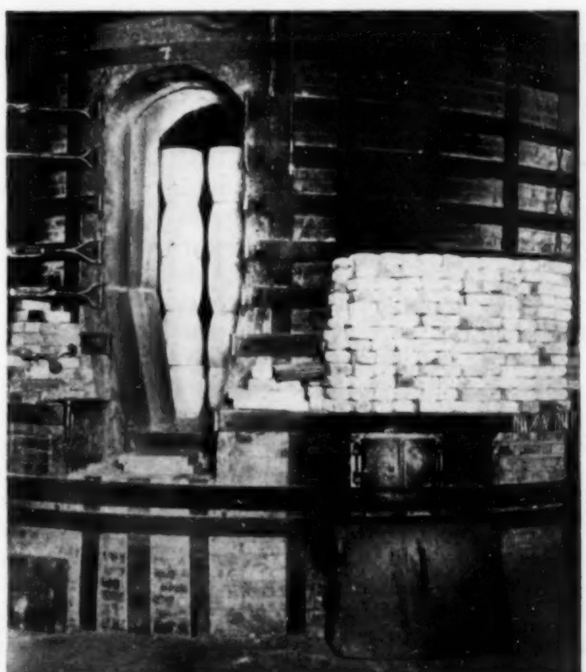


Fig. 4—Skillful Hand Work Is Required in Finishing Each Crucible

By this process a crucible of proper density and correct inside and outside dimensions is quickly built up. Then when the material has been formed, the crucible must be finished by hand. It is allowed to stand for a time in the mold, after which it is transferred to a small table mounted on a pivot, somewhat similar to a potter's wheel. Here a skilled operator smooths its surface and, if neces-

Fig. 5—Three Periodic Muffle Kilns Are Used in Burning the Ware



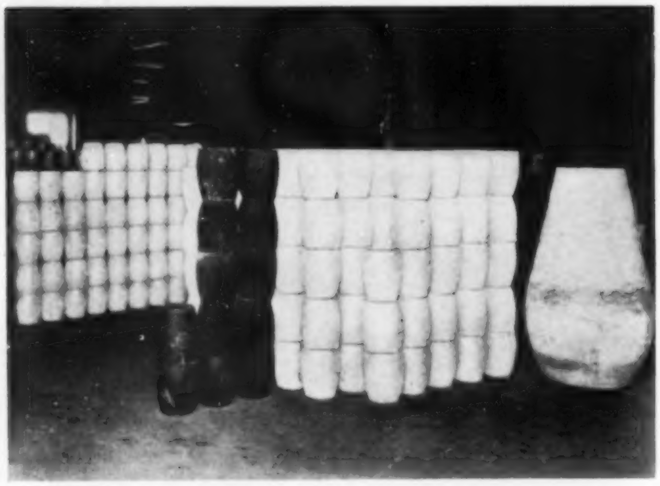


Fig. 6—A Section of Finished Crucible Storage; Note Large Crucible for Zinc Refining at Right

sary, forms a lip as in Fig. 4. Crucibles produced by such operations range in size from those having a capacity of only a few ounces to enormous bottle-like affairs, fully as tall as a man and capable of holding as much as 2 tons of zinc. One of the latter appears at the extreme right of Fig. 6.

The molded crucible must then be dried, an operation that requires great care to avoid cracking or distortion. For this purpose there is a large steam-heated dry room where the crucibles are subjected to gradually increasing temperature and decreasing humidity under constant psychrometric control. The drying operation requires four to six weeks and occasions a shrinkage of 5 per cent and a reduction in moisture content from about 20 to a few tenths of 1 per cent.

When drying is completed, the perfect crucibles—and there are very few losses—are moved to a periodic muffle kiln (Fig. 5), of which there are three. These are hand-fired with coal and so constructed that the flue gases do not come in contact with the ware, since it is desirable, for the sake of appearance and durability of the product, to avoid oxidation of the surface graphite.

Firing is controlled in each kiln by the readings of five thermocouple pyrometers, four in the sides and one in the crown of the kiln. The temperature at the crown is recorded and must follow closely a previously determined temperature curve which is marked on the chart. This procedure insures thorough calcining of the clays with little danger of cracking. After the crucibles have received the first burn, they are burned again in the same or a second kiln, and are then removed to storage (Fig. 6) and are ready for shipment to the customer.

▼ ▼ ▼

How Wood Distillation Survives in England

By MAURICE SCHOFIELD

Wolverhampton, England

THE general decline of wood-distillation activities since the war has been exemplified to some extent in Great Britain, where the severe competition of synthetic products has resulted in the closing down of certain factories. But the problems which have beset the British wood distiller differ in certain respects from those confronting American or Canadian distillers.

Meilers for burning are becoming rare sights in this country, compared with the considerable activities of such a nature in France and in Europe in general. There is still a certain preference for forest-burnt charcoal, accompanied by little or no scientific explanation as to the superiority in properties which created this preference. The temperature of the burning meiler is higher than the 400 deg. C. of the distillation oven, so that the deciding factor presumably is the higher carbon content.

The oven process is worked by a number of firms, the retorts used being similar to the standard American ovens. About a year's storage of the wood is allowed for seasoning, no predrying processes being in vogue. Ovens are not fitted with tar separators, while condensing and cooling systems are of the normal pattern. No kiln processes are in use in Britain, nor is there any process comparable to the Badger Stafford operations at Iron Mountain, Mich. There are, however, at least three companies concerned with the successful distillation of small waste from birchwood. The plants used are modifications of horizontal mechanical retorts which were employed at Dundee during the war period, and which were severely criticized at that time. A Scottish firm has continued to utilize this type of process with success for over 50 years, however, and the high grade of flake charcoal resulting is in demand for gunpowder and for cold-storage applications. A second firm engaged in this type of production has acquired patents for the carbonization in which the waste is impregnated prior to distillation with calcium acetate liquor from a wood-distillation process. The resulting distillate of creosote oil and acetone (from the decomposition of the calcium acetate) is withdrawn below 450 deg., while the ongoing mass is taken to 1,000 deg. C. to yield a highly active carbon.

The only other examples of utilization of small waste are furnished by firms which have installed gas producers, and by the activities of one concern using a modification of a rotary retort for low-temperature carbonization of shales.

The British wood distiller is concerned chiefly with the marketing of relatively small stocks of his various products in a number of directions. Pure methyl alcohol is not produced in Great Britain by distillation, the application of the crude spirit as a denaturant being one of the mainstays of the industry. Methyl acetone mixtures of various compositions are marketed as water-white solvents. Hardwood tar and the tar oils are finding new outlets, particularly in the fight against dry-rot fungus and various insect pests. The successful treatment of the woodwork in the roofs of Peterborough Cathedral affords an example of the value of these wood preservatives. Charcoal is no longer a special fuel in Britain, domestic iron having been displaced by the electric iron. It is now marketed as a definite chemical product for case-hardening mixtures and numerous minor uses.

Brown and gray acetates of lime and iron liquor constitute the chief market products of the acetic-acid section, for the textile industries create a steady demand for these materials. The Suida process is not in use in Britain, and modern refining plants for pure acetic acid and acetone also are lacking. Synthetic acetic acid and methanol are now established in the country.

PRIDE OF AUTHORSHIP

or

Seeing the World as Others See It

By JOHN MORRIS WEISS

Weiss & Downs, Inc.,
New York, N. Y.

THE SUCCESS of Briggs as a cartoonist was certainly to a large extent due to his keen insight into human nature. One series of his, entitled "Me and Mine," which you have probably seen, is based on the tendency of the average man to magnify mentally that which is his and depreciate the same thing if possessed by the other fellow. The proud parent is a typical example of this tendency, which may be called "Pride of Authorship."

Pride of Authorship enters the business world as well as the more personal relationships of mankind and crops up in many unexpected places. It is responsible for many real successes and likewise for many avoidable failures. None of us is free from it; we would be superhuman if we were. It is a powerful driving force like a mighty river and it seems wise to consider how to safeguard it, as the river is restrained by levees, so that at the proper time its force may be kept within its proper channels and diverted from destruction.

Throughout the entire course of technical development, we have to reckon with the pride of authorship, not only in individuals but in entire organizations. We must not repress it too far, for it is the material of which the much desired "esprit de corps" is made. It must be recognized, encouraged, but likewise restrained to an extent sufficient to allow its major conclusions to be submitted to adequate analysis.

PROCESSES usually start with a technical or scientific idea. No parent can be as jealous or enthusiastic as the more creative type of scientist with a new-born idea. If the first hasty experiments have even a modicum of promise, he is already visualizing the completed successful industry, inclined to brush away all suggested difficulties or obstacles with a wave of the hand, and forget entirely that the dividend is still in the distance. Such enthusiasm is a valuable asset, but if allowed to run without intelligent check-up, may prove disastrous. Such a check is the function of modern chemical engineering.

With any new proposition or idea, there is the necessity for a careful, impartial appraisal of the real commercial possibilities coupled with sufficient imagination to visualize these possibilities. This appraisal or review should precede any considerable expenditures of capital so as to determine whether the gamble—for all initial development work is a gamble—is a reasonable one. From the angle of the chemical engineer, the proper course is to take such information as is available, assume the process or idea will work as the originator desires, and set up a dollars and cents balance sheet of expected costs and returns. Of course, such a study will be very rough and many assumptions will have to be made, but these assumptions can be made on a maximum and minimum basis in most cases. Now, if all factors are chosen on the basis most favorable to the new development, and it still cannot be presented so as to show prospective profits, it is obvious that it should be abandoned. Sometimes, of course, the data available are insufficient to form a positive opinion, but in this case the review performs the very useful function of showing what information is essential. In this way the initial effort can be directed to the determination of these missing factors, and expenditure concentrated where it enables an intelligent decision to be made within the least space of time and at the least cost.

THE MOST DANGEROUS author, and indeed one with whom it is most difficult to deal, is one who has a major part in the direction of the company as a whole. When we have, for example, a vice-president in charge of manufacture who is an inventor of sorts, or who thinks he is, we have a situation which is difficult of restraint within the organization. His associates who could restrain him have not sufficient technical knowledge to appraise his ideas, while his subordinates, who have the knowledge, do not in many cases dare to tell him the truth. Men of this type do not take kindly to the most constructive criticism of their ideas and after a period become surrounded by a group of "yes" men, whose purpose in life is to glorify and flatter the boss and thereby hold their jobs. These pseudo-scientists in high executive positions are by no means rare and their experiments are costly.

In such a situation, a chemical engineer not directly responsible to the inventor-executive can serve as a balance wheel. His bread and butter must not depend on the favor of the executive, and if, as he should be, he is jealous of his own professional reputation for judgment, he will not hesitate to appraise the idea or projected development as cold-bloodedly as if it were the idea of anyone else in the organization. He must be tactful, but none the less, positive. Further, his advice will be taken with better grace and more alacrity than the same advice from a subordinate. A man is seldom a prophet in his own country. Usually, too, the failures of developments in such an organization are saddled on some obscure scapegoat who is unable to "pass the buck." Some $45-

per-week chemist or draftsman is fired, and the fact that some one higher up is really responsible does not become apparent until a multiplicity of unsuccessful ventures, staggering in their aggregate expense, wake the financial interests to the fact that all is not as it should be.

The financial interests of a company usually have the background to evaluate developments in sales policy, advertising, and similar purely commercial matters. They rarely have the background to similarly evaluate technical developments. To the average high-class business man or financier, there is a halo of mystery around these matters and always a promise of magical returns, returns which often are not realized. The chemical engineer can convert these mysteries into terms they can fully understand, and that understanding is very effective insurance against dissipation of assets in rainbow-chasing.

I do not want to be understood as in any way opposed to technical development, for I feel that any company which does not have an adequate development policy is open to suspicion and may at any time be rendered impotent because of obsolescence. However, unintelligent development and exaggerated pride of authorship not only divert assets into unproductive lines but actually prevent development along the lines where the company future should lie. It not only contracts present dividends but also those of the future, whereas intelligent technical development, while it may absorb capital for a time, inevitably gives disproportionately large returns later, and is the life blood of company growth.

This in rather general terms, is the aid given by the chemical engineer to interests already financially involved in a company or contemplating such a financial participation. In what specific way does a chemical engineer function in such matters, particularly in matters into which "pride of authorship" enters?

ALL BASIC DEVELOPMENT matters, when handled in a logical manner, pass through three well-defined phases: (1) laboratory; (2) semi-works; (3) pilot plant. The laboratory is the initial work on the very small scale. This is followed by the semi-works, which makes the product on a large enough scale to determine the essentials of plant design and to make enough product to test out the market. The final stage of pilot-plant operation is fully commercial, being the operation of a single full-scale unit to determine final costs and actually market the product. Duplication of pilot-plant units is all that is required for further commercial expansion.

It is at the end of each of the stages that the most important function of the chemical engineer enters. With all the information available, he projects a dollars and cents balance which indicates the results to be expected from the project, and on this basis it can be determined whether the next step is advisable and justified. In very unusual cases it may be sound judgment to go from the laboratory to the pilot-plant without the semi-works; in other words, to make the pilot plant the semi-works as well. In most instances this is a serious error of judgment but one which too much pride of authorship may lead an organization to do. Experimental work on the full scale always is costly and often foredoomed to failure. The chemical engineering balance brings out these points clearly; it sets maximum and minimum limits for costs at every stage and substitutes certainty for conjecture in so far as it is humanly possible. Much human action is based on 98 per cent rumor and 2 per cent fact, and it is the business of modern chemical engineering to reverse these percentages and attempt to reach the Ivory ideal of 99.44 as far as fact is concerned.

Often at the end of one or another stage of an investigation, a cold-blooded impartial marshaling of the facts shows that on any reasonable assumption as to the future, the work should stop right where it is. Pride of authorship is prone to make the unreasonable assumption which will justify continuance, regardless of the probability. The properly "engineered" financial man will say "All right, gamble on this if you will, but not with my money."

WHERE an industry is to be financed by additional capital, the source furnishing it makes a study of the industry as a matter of routine, and in these modern and progressive days gets the chemical engineering angle as well as those of the appraisal and the ordinary balance sheet. It has become more and more appreciated that a chemical engineering survey of plants and developments can go a long way toward predicting probable future profits. It is not so well recognized that a consideration of the general development of science and technology, and how this general exterior development is going to affect the interior affairs of the industry in question, is also of vital importance. Examples of industries thrown out of joint by such recent developments as synthetic ammonia and synthetic methyl alcohol are by no means rare. Although these developments had their effects only comparatively recently, yet one conversant with scientific progress could have readily predicted it several years before the event. The laboratories of all countries are busy with development work which is going to affect certain of our industries basically within the next decade. The scientific literature is full of sign-posts to those who can read and comprehend.

The work of the chemical engineer must not stop with the initial financing if the integrity of the investment and its maximum return is to be maintained. The financial interests back of any company which engages in major technical development should insure themselves by chemical engineering advice unbiased by pride of authorship. This can best be done by using an independent chemical engineer of the proper type to review major development matters at each stage of development where appropriations are required. In the last analysis such procedure is very cheap insurance. However, only in rare instances is it in actual operation today. Where it is, the effect on the organization is salutary.

Furthermore, knowing that each proposition put up for approval is to be subjected to critical analysis, there will at once be a tendency toward intelligent conservatism and more critical review within the organization. There will be proper hesitancy in pushing forward schemes which are half-baked in their technical phases and which, in the absence of critical technical check-ups, might be expected to slip through unnoticed. Less total development may be the result, but the sum total of productive development and consequent dividends will be greater.

I have merely touched the high spots of some of the uses of chemical engineering to the modern financier. The interests of the financier and the chemical engineer are identical, as far as industry is concerned, and they should endeavor to understand one another better. Much progress has already been made in this direction, but much more is yet to come. Then there will be less lost motion, even more intelligent financial management, and further increase in dividends, all of which are certainly desired for the development and extension of American industry.

READERS' VIEWS AND COMMENTS

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Ammonia Cost Calculations

In two articles appearing in the February and March issues of *Chem. & Met.*, W. F. Scholvien described the Mont Cenis process of ammonia synthesis at length, giving detailed production and cost figures. When a number of readers told us of difficulty in arriving at the figure of \$3.60 as the cost of coke-oven gas required for 1 ton of ammonia (Table VI, p. 134, March, 1931) Mr. Scholvien was asked to detail his calculations. His explanation follows:

In the Mont Cenis process plants now operating the cost of coke-oven gas is based not on the quantity of gas processed for the recovery of hydrogen but on the number of B.t.u. extracted as hydrogen before the residual gas is returned to the coke-oven plant. Gas is metered and its calorific value obtained when it enters the separation plant as coke-oven gas, and again when it leaves as residual gas, with most of its hydrogen extracted. The charge is then made on the difference between total B.t.u. received and returned for credit.

Therefore, to determine the cost of coke-oven gas per ton of ammonia produced we have the following data:

February, 1931, p. 84: Coke-oven gas = 467 B.t.u. per cu.ft.
= 55.4 per cent hydrogen
92-93 per cent of hydrogen in gas is recoverable

March, 1931, p. 133: 1 lb. NH_3 requires 37 cu.ft. of hydrogen
p. 134: Coke-oven gas costs 7½c. per M cu.ft.
Coke-oven gas costs 7½c. per 467,000 B.t.u.

B.t.u. Breakdown of Coke-Oven Gas

Recoverable hydrogen $= 0.554 \times 0.92 = 0.509$ cu.ft. per cu.ft. of coke-oven gas.

Residual gas $= 1.000 - 0.509 \doteq 0.491$ cu.ft. per cu.ft. of coke-oven gas.

And 1 cu.ft. of coke-oven gas $= 289 \times 0.509 = 147$ B.t.u. as hydrogen, $+\ 467 - 147 = 320$ B.t.u. as residual gas.

B.t.u. per ton of Ammonia Produced

Hydrogen per ton $NH_3 = 37 \times 289 \times 2{,}000 = 21{,}400{,}000$ B.t.u.

$\frac{21{,}400{,}000}{147} = 145{,}000$ cu.ft. coke-oven gas to be separated.

$145{,}000 \times 0.509 = 74{,}000$ cu.ft. of hydrogen produced.
$145{,}000 \times 0.491 = 71{,}000$* cu.ft. of residual gas produced.
$145{,}000 \times 467 = 67{,}900{,}000$ B.t.u. as coke-oven gas.
$74{,}000 \times 289 = 21{,}400{,}000$ B.t.u. as hydrogen.

$\frac{71{,}000 \times 320}{0.491} = 46{,}500{,}000$ B.t.u. as residual gas.

And $\frac{21{,}400{,}000 \times 0.075}{467{,}000} = \$3.44$ for coke-oven gas per ton of ammonia produced. Including losses, the cost of coke-oven gas per ton of ammonia may be taken as \$3.60.

Inquiry was also made concerning the oxygen which is produced as a byproduct of the nitrogen separation. Mr. Scholvien states that the purity of this oxygen is normally 98 per cent, but that where 99.5 per cent oxygen is required in one plant, auxiliary apparatus has been installed to make this possible. In a plant of 100 tons daily ammonia capacity, oxygen production is 640,000 cu.ft. daily. In the plants where the oxygen is sold it is necessary to build an inexpensive filling station for cylinders. Certain of the plants are using the oxygen to enrich air for ammonia oxidation. The yield of nitric acid has been found to improve when the enriched air is used with standard catalyst gauzes. It has been found that 640,000 cu.ft. of oxygen under these circumstances is enough for the efficient combustion of 44 tons of ammonia.

*Does not include the nitrogen introduced during the gas separation.

Triple Superphosphate

To the Editor of Chem. & Met.:

Sir:—One economic procedure to obtain effective use of phosphoric acid is suggested to me, since my article in the January issue, by Mr. K. D. Jacob, of the Bureau of Chemistry and Soils. This suggestion contemplates the use of phosphoric acid primarily for making triple superphosphate, in order to add thereby 50 per cent to the total P_2O_5 content of the product without requiring production of additional phosphoric acid as such. The resulting triple superphosphate still remains a splendid carrier for ammonia. Recent work indicates that such a product can be ammoniated up to 8 or 10 per cent NH_3 content without occasioning any reversion of the P_2O_5 to unavailable form. The additional available P_2O_5 obtained from the rock used in the triple superphosphate manufacture therefore contributes its fertilizing value without decreasing the ammonia carrying power. Where a maximum of fertilizer production with a minimum of acid-plant operation is desired, this procedure obviously has a substantial advantage.

R. S. McBride.
Washington, D. C.

Triethanolamine Absorption

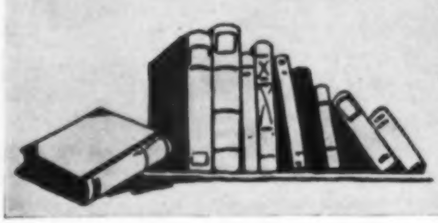
To the Editor of Chem. & Met.:

Sir:—In reading Dr. Reich's excellent article on "Liquid CO_2" in your March issue, I noticed the reference to triethanolamine as absorbent for CO_2 and to its manufacturer. It would be to the interest of everyone concerned, I think, to point out that this precise application of the material is covered by U. S. Patent 1,783,901, owned by the Girdler Corp.

E. G. Luening.
Vice-President
The Girdler Corp.
Louisville, Ky.

Correction—In an article by Harry E. Stitt appearing in the April, 1931, issue of *Chem. & Met.*, an error in transcription in the blue print on page 197 resulted in listing the relative price of drop siding on wood studding as 13 per cent, whereas Mr. Stitt has pointed out that it should have been 19 per cent.

Chemical Engineer's Bookshelf



Electrochemical Progress

Die Neueren Fortschritte der Technischen Electrolyse. By *J. Billiter*. Verlag Wilhelm Knapp, Halle, Germany, 1930. 328 pages. Price, 22 M.

Reviewed by C. L. Mantell

An EXTENSION of parts 1, 2, and 3 of the author's "Technischen Electrochemie," this volume brings the subject matter up to date and records the intervening progress. Under copper, furnace melting, refining, and electrowinning are treated; under silver, its electrolytic recovery from alloys; under gold, its refining; under lead, the American developments of electrolytic lead and white lead; the recent development of electrolytic nickel refining is not included. Under tin, the treatment is a review, while recent German developments appear to have been left out. Under zinc, the Tainton and Anaconda methods are described in considerable detail. Cadmium is given four pages; iron, six; and the electrolytic preparation of material such as sheets and tubes, 16 pages.

Under electrolytic hydrogen and oxygen, 46 pages describe the new large-size cells, particularly of the filter-press type, which find little application in the United States, and pressure electrolysis. A chapter is given to the electrolytic desalting of water and another to oxidation products and persalts. Under electro-osmose and electro-phorese, only mention is made of the important development of rubber plating. Considerable review is found in the 58 pages devoted to chlorine, caustic, and chlorates. The third section of the book covers sodium from sodium chloride, beryllium, aluminum (with only brief mention of new phases), lithium, calcium, magnesium, and cerium—the last four within seven pages.

When the difficulty of obtaining data on new developments is taken into account, the book is a welcome addition to the practical electrochemical literature.

Manufacturing Economics

Quantity and Economy in Manufacture. By *Fairfield E. Raymond*. McGraw-Hill Book Co., New York City, 1931. 375 pages. Price, $4.

Reviewed by George A. Prochazka, Jr.

THE USE of one machine to make a number of different products burdens management with the problem of deciding how much to make of one item before shifting the operations to another article. The author points out the ten major factors and the minor elements which must be considered in determining economic production quantities. Not all of these variables enter into any one problem.

By carefully arranging his subject matter the author has added greatly to the value of the text. Too often writers are prone to overlook the reader on this score. There are three parts to the book. The first deals with the general utility of determining economic production quantities. The second takes up the underlying theory, and the third, in appendix form, presents mathematical derivations and the evaluation of some of the factors of the problem.

The first three chapters are addressed to the industrial executives who wish to know how their businesses may profit by the use of this more precise method of management. Calculation sheets and graphs have been included, and mechanical means for solving problems have been suggested for the use of the practical man. A matter vital to mathematical subjects has not been overlooked in that the manner of solving practical problems has been illustrated by examples.

The reviewer is pleased to be able to note that this book is a scholarly piece of work. It has been based on research conducted at the Massachusetts Institute of Technology and should not, by any means, be limited in application to the industries that are most deeply concerned with the problem of economic production quantities. The book is well indexed and contains a carefully selected bibliography. A short chapter on the historical side of the subject will prove of particular benefit to the reader. The immense value of such a discussion in the presentation of a subject is frequently overlooked.

Industrial Rôle of Minerals

Minerals in Modern Industry. By *Walter H. Voskuil*. John Wiley & Sons, Inc., New York, 1930.

Reviewed by Paul M. Tyler

ECONOMISTS have been quick to grasp the dominant place that minerals occupy in modern life. A considerable literature has grown up about this theme, particularly since the World War brought home the fact that an army no longer travels on its belly so much as it does on motor trucks and other products of a machine age. The provision of a few pounds of food presents far less of a problem nowadays than the assembly and timely transport of tons of metals and other munitions of mineral origin. In his peaceful pursuits, likewise, man has progressed from pastoral to agricultural and now increasingly to mechanical and metallurgical activities. The appearance of a new book on the subject of "Minerals in Modern Industry" must of necessity reflect ideas that are not new, and forward

opinions that are, to say the least, controversial. In the preface acknowledgment is made to C. K. Leith, in whose classes at the University of Wisconsin, Voskuil doubtless found not only the inspiration but also most of the basic structure of the present volume, which is the further result of teaching work (1926-1930) at the University of Pennsylvania.

The introductory chapters successfully present, in proper perspective, the place of minerals and power in industry; they are well written and form interesting reading, especially to the student who approaches the subject for the first time. Next comes a series of thumb-nail summaries of the situations surrounding the supply and consumption of individual fuels and other economic minerals. Coal occupies four chapters and petroleum three. Other chapter headings relate to natural gas, iron, ferro-alloying elements, copper, bauxite and aluminum, lead and zinc, minor industrial minerals, nitrogen, phosphates, potash, sulphur, and cement.

Several of these summaries are not too carefully prepared. The editing also might have been better, as chromite is confused with chromates, and molybdite instead of molybdenite is described as the commercial mineral of molybdenum. The main trouble, however, is the inherent difficulty of depicting in a still photograph the dynamic condition of an industry. It would seem as reasonable to challenge the concepts of the law of gravitation by exhibiting a snapshot of a horse jumping high over a fence as it is to deduce economic laws from a fleeting glimpse of the statistics of a single year. In view of the fact that domestic mines contributed in 1929 roughly two-thirds of the indicated domestic supply of mercury, and in 1930 a far larger proportion, the statement in a newly published book that domestic production supplies only about one-fourth of the annual needs is unfortunate, even when annotated against authoritative original statements relative to the year 1925.

In the last chapter, entitled "Some Problems of the Mineral Industry," the reviewer is tempted to engage in argument, but there are those who will accept whole the dogma contained in it—and like it. This discussion, in common with other portions of the book, is not a challenge to argument so much as it is a well-written digest of the available literature on the subject, most of which, unfortunately, has emanated from a relatively small group of pragmatical internationalists. In so far as it summarizes and gives popular utterance to such theories, the book serves a useful purpose, and may properly be included in the libraries of those interested in the trend of modern industrial thought.

The "Mighty Electron" in Industry

PHOTOELECTRIC CELLS AND THEIR APPLICATIONS. By *V. K. Zworykin* and *E. D. Wilson*. John Wiley & Sons, New York, 1930. 209 pages. Price, $2.50.

Reviewed by H. L. YOUNG

USHERED in with all the ballyhoo of present-day publicity, "the electric eye" commands the public attention for the moment. Newspapers and magazines have given much space to company releases on the new developments. Considerable space has been given also to the conjectures of the pseudo-scientists who have seized upon this latest novelty with their usual avidity.

Meanwhile, beneath this froth the technical writings of the developers of these light-sensitive devices have been appearing in journals not generally available. Chemical engineers who saw possible applications to their problems have needed a reliable and comprehensive statement of the present status. They will be grateful, therefore, for this little summary.

According to the preface, the authors have set for themselves that frequently essayed task of educating the layman, while yet informing the specialist. Unfortunately, most scientists are so steeped in the knowledge of their fields that they find it difficult to comprehend how ignorant the layman really is. Possibly this is in great part responsible for the charge that technical men do not know how to write.

In the use of this "lusty child of rapid growth" most chemical engineers will find themselves among the laity. And they will, in the opinion of this reviewer, wish frequently that the authors had included many more details. By so doing, they would have spared the reader much questioning and the necessity of referring to the sources listed in a very adequate bibliography. An example of this regrettable brevity is the chapter on the preparation of photocells, a subject which should be especially informative to the layman. It is accorded about the same space as the one application of television. Aside from this defect, the authors are to be commended. It is to be hoped that they will later expand this work.

The arrangement of the material is logical, with the first section given to a discussion of the history, theory and mechanical features of phototubes. This is followed by a consideration of the methods of amplification of the output. The final chapters are devoted to applications in "sound" moving pictures, television, and the industrial uses of matching colors, of counting, sorting, measuring, and controlling. Much of this may prove suggestive to the chemical engineer.

Taylor's Physical Chemistry

TREATISE ON PHYSICAL CHEMISTRY. Edited by *H. S. Taylor*. D. Van Nostrand Company, New York, 1931. 2 vols. 1,766 pages. Price, $15.

Reviewed by H. H. LOWRY

THAT the field of physical chemistry is growing rapidly is well shown by the new edition of Taylor with its greatly increased size. The general divisions in the new edition follow closely the divisions in the first edition, which appeared in 1924. In any compilation such as the present work, different subjects are treated in a way peculiar to the particular author, and the thoroughness varies considerably. This is true also in the revision, where certain chapters have been thoroughly brought up to date, while certain of the others have not been so treated.

The authors of some of the chapters have been changed. The chapters on the "Gaseous and Liquid State of Aggregation," which, in the earlier edition were written by Dr. Otto Maass, have been changed to chapters on the "Kinetic Theory of Gases and Liquids" and "Imperfect Gases in the Liquid State," under the co-authorship of Dr. K. F. Herzfeld and Dr. H. M. Smallwood, who have given a very thorough treatment of this subject. Dr. T. J. Webb has been added as a co-author with Dr. W. H. Rodebush for the chapter on the "Third Law of Thermodynamics and the Calculation of Chemical Constants." Dr. E. O. Kraemer replaces Dr. W. A.

Patrick as author for the chapter on "Colloids," and gives a very much more comprehensive treatment, which is more in accord with the importance of the study of colloids in the field of physical chemistry today.

With the exception of the chapter on "Quantum Theory and Atomic Structure," by Dr. Saul Dushman, and the chapter on "Infra-Red Radiation in Chemical Processes," by Dr. H. A. Taylor, the general treatment of the other chapters is very much the same as in the first edition. The chapter on "Quantum Theory" has been more than doubled, with a very interesting and thorough account which would well repay the reading by any physical chemist. The chapter on "Infra-Red Radiation" also has been more than doubled, which has been necessary in order to take care of the large amount of work that has been done in band spectra in recent years.

Due to the method of treatment, this "Treatise on Physical Chemistry" does not lend itself well for use as a textbook in physical chemistry, since certain subjects are very inadequately treated. Rather, these volumes must be regarded more as reference works, comprising a series of very excellent monographs on selected subjects in physical chemistry. I would call attention particularly to the very inadequate treatment of liquids and the borderline between liquids and crystalline solids. There is practically no account of the enormous amount of work which has been done in recent years in dielectrics, including the determination of electric moments and molecular refraction.

A few words may be permitted for a discussion of the physical make-up of the book. In general, the printing is excellent, though there are numerous typographical errors, both in the text and in the mathematics. The reviewer would prefer to have the book printed on paper with less gloss, since the reading of the book under artificial light becomes quite a strain on the eyes.

It would seem highly desirable to have the literature references given in a consistent manner in the different chapters. The author index as given loses some of its usefulness, due to the fact that the initials are not always given, and in many cases several individuals are grouped under a common name.

Organic Chemistry

STRUCTURE SYMBOLS OF ORGANIC COMPOUNDS. By *Ingo W. D. Hackh.* P. Blakiston's Son & Co., Inc., Philadelphia, Pa., 1931. 139 pages. Price, $2.50.—Because it describes itself as an "adjunct to textbooks of organic chemistry" the book offhand might offer no attraction to those long freed from academic durance. Instead, its two principal sections, introduction and symbol tables, are so tersely informative that anyone with a chemical background will gain from its perusal. The point developed is the necessity for more representative, yet more convenient, organic symbols; and Dr. Hackh's method, though not the only one, is at least convincing. In his skillful exposition, moreover, he sheds light on present ideas of organic structure that will be welcome to rusty ex-students who cannot spend their entire leisure on the subject.

THE VITAMINS. By *H. C. Sherman* and *S. L. Smith.* Second Edition. Chemical Catalog Company, New York, 1931. 575 pages. Price, $6.—Considering the advance of knowledge on the subject since the first edition appeared—for example, the recognition that no vitamin has ever been actually identified—it was high time that an authority again made the present scientific status conveniently accessible. Each vitamin is treated separately, in the form of a complete narrative record of research up to 1930. The bibliography occupies 182 of the pages, in addition to two complete indexes.

ESSENTIALS OF ORGANIC AND BIOLOGICAL CHEMISTRY. By *E. Wertheim.* Chemical Publishing Company, Inc., Easton, Pa., 1931. 175 pages. Price, $2.50—As the title suggests, the author proceeds from the simple to the more complex organic structures, treating them in relation to their biologic significance. The treatment is brief and clear but intended for the less advanced reader.

TRATTATO DI CHIMICA ORGANICA. By *Giuseppe Oddo.* Casa Remo Sandron, Palermo, Sicily. 949 pages—While it is not justifiable to weigh the merits of this treatise here, it may be pointed out that it covers the whole territory within one volume in compact form and is copiously illustrated with drawings of commercial apparatus for production of the chemicals involved. It is another evidence that European books are not directed strictly to one class; its usefulness is undoubtedly accessible to the student, the research worker, or the industrialist.

Newly Arrived

PROGRESS OF APPLIED CHEMISTRY. Report issued by the Society of Chemical Industry, Central House, London, 1931. 745 pages. Price: 7s. 6d. to members; 12s. 6d. to others—Without sacrificing anything in the way of content, this year's volume appears six weeks earlier than usual, and thus sets a salutary example to the American "Annual Survey." An advantage of this British publication has always been its universality within the complete scope of chemical industry that it covers. Without becoming less indispensable, the present volume has the objection that in some cases the status of a particular industry has not been completely grasped and that there are some confusing arrangements, such as occur in the chapter on heavy chemicals. It should be almost obligatory for any technologist to read annually at least the section on his own industry in this and its American counterpart.

INVESTIGATION OF THE MANUFACTURE OF WATER GAS, with especial reference to the decomposition of steam. By *Lloyd Logan.* Dissertation, Department of Gas Engineering, Johns Hopkins University, Baltimore, Md., 1931. 105 pages. Price, $1.25.—This is the second of the series of dissertations that Prof. Huff's department is making generally available. It is an excellent and comprehensive study of the water-gas process, starting from the groundwork and investigating the thermodynamics in all its complicated phases. A desirable result of this investigation would be some earnest experimental work on the various alternatives that the author proposes from his several findings.

PROTECTION AND DECORATION OF CONCRETE. By *Maximilian Toch.* The Van Nostrand Company, Inc., New York City, 1931. 54 pages, Price $2—A leading paint chemist has here written a brief illustrated summary of concrete treatment, a field in which there has not been a similar previous work.

DIZIONARIO DI MERCEOLOGIA E DI CHIMICA APPLICATA. Vol. 3. By *G. Vittorio Villavecchia.* Ulrico Hoepli, Milano, 1931. 1043 pages—This volume brings almost to completion this rejuvenated industrial chemical dictionary, and only the fourth now remains to appear. The advantages of its extended scope are the inclusion of tabular matter and detailed description not usually found in dictionaries.

PROCEEDINGS, AMERICAN SOCIETY FOR TESTING MATERIALS. Vol. 30. Published by the Society at 1315 Spruce Street, Philadelphia, Pa., 1931. Part I, 1336 pages; part II, 1085 pages. Price, $6.50 each, cloth—The first part of these 33d annual proceedings contains the annual reports of 48 standing committees of the society. It includes a wide range of materials and specifications, and contains the tables of data on alloys that was published separately in March and mentioned in this column. The second part publishes the technical papers of the meeting at Atlantic City last June.

Selections from Recent Literature

Equipment for Nitric Acid. A. Matagrin. *Revue de Chimie Industrielle.* March; pp. 70-78. Glass and ceramic ware had an important part in nitric-acid production when nitrates were used as raw material, but in the newer technology of atmospheric nitrogen it became essential to operate in metal apparatus. Nickel and aluminum have had some place in this development, but the major contribution to the art has been the development of acid-resisting steels. This is partly due to the very severe mechanical conditions which are imposed by modern processes of manufacture. The initial cost of chrome-nickel steels is comparatively high, but this is compensated by long service life, resistance to mechanical shock and thermal stresses, and increased safety factor with respect to explosion hazards. Photographs are shown, with discussion of operating data and the properties of the metal, of apparatus made of "Platinostainless," a chrome-nickel steel of European make. The pieces shown include a tubular dephlegmator, a montejus (riveted construction), a pump rotor, a fan housing, piping, and tubular condensers.

Carborundum in Fractionation. Esther C. Farnham. *Journal of Physical Chemistry,* March; pp. 844-58. To ascertain the reason for the beneficial effect of carborundum on the separation of liquids in a fractionating column, a comparison was made with the behavior of glass beads, tourmaline, and micaceous hematite. The test liquids were mixtures of alcohol and water, benzene and pyridine, benzene and toluene, and water and pyridine. The results indicate that selective adsorption has an important influence. From first thought, it would seem that very strong adsorption of the higher-boiling component should be the objective in selective adsorption for the purpose of aiding fractionation. It is shown that this idea is based on fallacious reasoning. Experience from the comparative trials indicates that both the chemical nature and physical structure of the column filling have their influence on the sharpness of the separation. Other things being equal, thin plates give a better effect than needle-shaped units. Comparative results with different column fillings are shown in curve charts.

Reactivating Adsorbents. O. Eckart. *Seifensieder-Zeitung,* March 26; pp. 200-1. Although many methods have been proposed for reactivating spent adsorbents, used in refining or clarifying various kinds of oils, the practice of reactivating the spent adsorbent has not been widely adopted. A major reason for this is that the reactivation does not totally restore the original activity, so that there is a decrease with every reactivation. Hence an economic limitation is imposed on the use of reactivated adsorbent. In general, it may be said that reactivation is not profitable in the case of the cheap decolorizing earth unless the quantity to be reactivated is at least 15 tons per day. This figure is based on prevailing European conditions, and is the least quantity for which there is a satisfactory return on the necessary capital outlay. Mineral oil refineries operate on a sufficiently large scale so that many of them can make reactivation pay a return on the investment, but the vegetable and animal oil industries do not have such large establishments. The treatment must be repeated, much as in making the fresh adsorbent; mere roasting does not by any means give a satisfactory product for re-use. Owing to the loss of activity with each treatment, the number of cycles for a given batch of adsorbent is strictly limited. Earths used for clarifying can be used over and over again, but decolorizing earths have at best a much shorter life.

Electrochemical Sulphonation. F. Fichter, H. E. Suenderhauf, and A. Goldach. *Helvetica Chimica Acta,* February; pp. 249-53. A statement has persisted in the literature for 30 years, even in Beilstein, to the effect that p-sulphobenzoic acid can be made by electrolyzing a mixture of toluene, alcohol, and sulphuric acid. Since there are some attractive features in the idea of adapting electrochemical methods to the sulphonation of aromatic compounds, attempts were made to produce p-sulphobenzoic acid as described in the literature. Since alcohol greatly complicates the picture by introducing another organic compound into the reacting system, experiments were first made without alcohol. On the other hand, alcohol makes the solution homogeneous, so that the sulphuric acid can act on the hydrocarbon nearly or quite in the absence of water, thus favoring sulphonation. But when experiments were made in the presence of alcohol, it was found that the product which had been reported by the early investigators was actually a salt of ethyl sulphuric acid. From the results of this investigation, it seems doubtful that electrochemical methods can be successfully applied to sulphonations.

Tubular Rotary Evaporator. Amaury Dumoulin. *Bulletin de l'Association des Chimistes de Sucrerie,* March; pp. 108-16. The Lafeuille rotary evaporator for boiling down syrup was developed to overcome the difficulties encountered in ordinary evaporating systems. It is a modification of the Lafeuille crystallizing evaporator, and comprises a horizontal cylinder having two rotary circular paths. This cylinder rotates on eight steel rolls mounted in pairs on compensating supports. The heat exchange surface is formed of horizontal bundles of radially disposed tubes, 45 to 50 mm. in diameter. The same tubes serve alternately for heating by means of exhaust steam and for cooling with running water. The recommended rate of rotation is 12 to 24 r.p.m. Vacuum is provided by having one end of the cylinder extended into a vacuum chamber slightly larger in diameter than the cylinder. The vacuum line is so disposed that syrup droplets cannot be carried into it by entrainment. The apparatus is described in detail in the light of the operating principles and economics.

Hygroscopicity of Wood. Carl G. Schwalbe and Kurt Berndt. *Kolloid-Zeitschrift,* March; pp. 314-26. The hygroscopic behavior of wood is a problem which is of interest to all wood-using industries. A study has therefore been made of the influence of drying conditions and of swelling behavior on the hygroscopicity of wood. The factors investigated were: hot-air drying, drying in oxygen and in nitrogen, pre-swelling in water, pre-swelling in wet steam, reversibility of swelling, and drying with organic solvents. The woods examined were pine and fir. It was found that decrease in swelling capacity due to hot-air drying does not result from oxidation; no differences were observed in the experiments with oxygen and nitrogen. Pre-swelling in water caused an increase in hygroscopicity; so also did pre-swelling in wet steam. The swelling behavior is influenced by the fact that swelling is reversible; but there is hysteresis in the swelling cycle; i.e., the reversibility is not complete. Extreme drying lessens the swelling capacity. The experiments with organic solvents (benzene, alcohol, and the like) indicate that this method of drying does not cause any significant change in hygroscopicity, nor decrease in swelling capacity.

Chemicals for Flotation. E. W. Mayer. *Chemiker-Zeitung,* March 22; pp. 229-30; March 29, pp. 250-1. Since the advent of chemical reagents as aids to ore separation by selective flotation, much progress has been made on the basis of specific functions of various chemicals. Two groups of functions are recognized: namely, direct and accessory aids to the flotation process. The direct aids are either "collectors" or "frothers." Among the accessory reagents are passivating (depressing) agents, conditioners, modifying agents, activators, and antitoxic agents. The chief contribution of thiocarbanilide and the xanthates is that, as collectors, they permit operation in an alkaline medium;

for the earlier collectors alkalinity was unfavorable. Depressing agents must be electrolytes, serving to improve the wetting behavior of ore particles by forming with an ion of the ore a polar compound, or reacting with a component of the system to form a polar (hydrophilic) compound to facilitate wetting of the ore particles. The activators, which include both conditioning and modifying agents, serve to restore the floatability of ore particles after the use of depressing agents. They must be polar compounds, having affinity both for the mineral surface and for the polar component of the collector. They function by modifying the ore particle surfaces in such a way that the collector will again adhere to them. Toxic agents, chiefly ions of heavy metals and certain colloidal impurities, are often present in the ore flotation system and must be counteracted by use of antitoxic agents. Applications of these principles are discussed.

SOLVENT EXTRACTION. A. E. Williams. *Industrial Chemist*, April; pp. 161-5. In the solvent extraction of vegetable oils, European practice tends to favor the rotary horizontal type of extractor, for which no agitator is required. Vertical extractors are finding wider preference in Great Britain, however; this type of equipment is more adaptable to large-scale production. In the most modern design of vertical extraction plant, control valves are grouped together so that attention to the apparatus is facilitated, and one man can carry on the entire operation. As a safety precaution, safety valves are provided where excess pressures might develop; but these are now constructed so that, in case they are called upon to function, the escaping vapor is blown to the condenser and not to the atmosphere. In the interests of economy, efficient solvent recovery is necessary. British practice favors the adsorption method, using activated charcoal as adsorbent. This type of recovery plant is particularly advantageous when the solvent in use is soluble in water, because for such a solvent, recovery by condensation and distillation is difficult and expensive. Even for a water-insoluble solvent, the condensation method has the disadvantage of requiring a large supply of cooling water, which must be maintained regardless of fluctuations in the solvent vapor content of the effluent air. The operating costs for this method are high as compared with the adsorption method. A typical modern extraction plant of the vertical type is described, and illustrated with photographs of the equipment.

Recent Government Publications

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Census of Dyes and Other Synthetic Organic Chemicals. Preliminary mimeographed report from the U. S. Tariff Commission for 1930.

Statistics Concerning Intoxicating Liquors. Pamphlet issued by Bureau of Industrial Alcohol; 15 cents.

Depreciation Studies. Preliminary report of the Bureau of Internal Revenue; 5 cents. Shows allowed rates for many types of plant equipment.

Diatomite, by Paul Hatmaker, Bureau of Mines Information Circular 6391; mimeographed economic mineral survey.

Platinum, by Paul M. Tyler and R. M. Santmyers. Bureau of Mines Information Circular 6389; mimeographed economic mineral survey.

Magnesium Compounds (Other than Magnesite), by Paul M. Tyler. Bureau of Mines Information Circular 6406; mimeographed economic mineral survey.

Method and Cost of Recovering Quicksilver From Low-Grade Ore at the Reduction Plant of the Sulphur Bank Syndicate, Clearlake, Calif., by Werthen Bradley, Bureau of Mines Information Circular 6429; mimeographed.

Copper and Zinc in Cyanidation Sulphide-Acid Precipitation, by Edmund S. Leaver and Jesse A. Woolf. Bureau of Mines Technical Paper 494; 15 cents.

Secondary Metals in 1929, by J. P. Dunlop. Bureau of Mines Mineral Resources pamphlet; 5 cents. Statistical report.

Mineral Production Statistics for 1930—preliminary mimeographed statements from the Bureau of Mines on: Sulphur, liquefied petroleum gases, aluminum, gypsum, pyrites, fuel briquets, and zinc.

The Absorption of Nitrogen by Steel, by R. S. Dean. Bureau of Mines Report of Investigations 3,076; mimeographed.

Leather Industry and Trade of Germany, by J. Schnitzer. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 744; 10 cents.

Leather Production and Trade of Austria, by J. Schnitzer. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 747; 10 cents.

British Chemical Developments in 1930, by Roger R. Townsend. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 750; 10 cents.

Petroleum Industry of the Gulf Southwest, by Charles B. Eliot. Bureau of foreign and Domestic Commerce Domestic Commerce Series 44; 65 cents.

A Study of the Properties of Polyhalite Pertaining to the Extraction of Potash: Part III—Calcination of Polyhalite in a Laboratory-Size Rotary Kiln, by L. Clarke, J. M. Davidson, and H. H. Storch; Part IV—Experiments on the Production of Potassium Chloride by the Evaporation of Leach Liquors From Decomposition of Uncalcined Polyhalite by Boiling Saturated Sodium Chloride Solutions, by H. H. Storch. Mimeographed. Bureau of Mines Reports of Investigations 3,061 and 3,062, respectively.

Note on Copper-Constantan Thermocouple Calibration Below 0 Deg. C., by R. Wiebe and M. J. Brevoort. Bureau of Mines Report of Investigations 3,077; mimeographed.

Standards Yearbook, 1931. Bound volume issued by the Bureau of Standards; $1. A standardization reference book.

Leaching Copper Ores: Advantages of Wet-Charging, by John D. Sullivan and Alfred P. Towne. Bureau of Mines Report of Investigations 3,050; mimeographed.

The Portuguese Naval Stores Industry. Bureau of Foreign and Domestic Commerce Chemical Division Special Circular 333; mimeographed.

Government Specifications, issued by the Federal Standard Stock Catalogue Board on: Lead-zinc base paints, ready mixed and semi-paste, white and tinted; masonry cement; portland cement; hydrated lime for structural purposes; and flake lubricating graphite. 5 cents each.

Wood Pulp. Special report from the Census of Manufactures, 1929; mimeographed. Data by States and by kinds of wood used.

The Reaction Between Magnetite and Ferrous Sulphide: Part II, by F. S. Wartman and G. L. Oldright. Bureau of Mines Report of Investigations 3,072; mimeographed.

Miscellaneous Publications

Symbols for Heat and Thermodynamics. American tentative standards, American Standard Association, New York City. Price, 30c.—List of symbols tentatively adopted after several years' preparation.

Flow of Liquids in Pipes of Circular and Annular Cross-Sections. By Alonzo Kratz, Horace J. McIntyre, and Richard E. Gould. Bulletin No. 222, Engineering Experiment Station, University of Illinois, Urbana. 28 pages. Price, 15c.

Research Service for Industry. Department of Engineering Research, University of Michigan, Ann Arbor. 40 pages.—Well-illustrated description of facilities offered by this university for cooperative engineering research service with industry, and conditions under which it is carried on.

Possible Industrial Applications for Bentonite. By Hugh F. Spence and Margaret Light. Department of Mines, Canada, Ottawa. 24 pages.—A short general study accompanied by patent classification of uses.

American Standards, 1931 Year Book. American Standards Association, New York City. 102 pages—An annual report on activities and a review of standardization development.

Embrittlement in Boilers. By Frederick G. Straub. Report of an investigation conducted by University of Illinois, Engineering Experiment Station, with the Utilities Research Commission. Bulletin No. 216, Engineering Experiment Station, Urbana, Ill. 128 pages. Price, 65c.

Lime in Agriculture. Bulletin 190, National Lime Association, Washington, D. C 53 pages. Free on request.

British Chemicals and Their Manufactures. Association of British Chemical Manufacturers, London, 1931. 405 pages. Free on request—Revision of a similar work last published in 1929, in English and five other lauguages.

Directory of Members, 1931, the British Chemical Plant Manufacturers' Association. Association of British Chemical Manufacturers, London, 1931—Members are listed by name and by product.

The Salt Industry of Canada. By L. Heber Cole. Department of Mines, Ottawa, Canada. 116 pages and maps. Price 20c. —A survey of salt occurrence in the Dominion, methods of manufacture, and marketing.

The Mineral Industry of the British Empire and Foreign Countries. Statistical summary, 1927-29. The Imperial Institute, London, 1930. 371 pages. Price 5s. 6d.—A good checking reference on production, imports, and exports of mineral raw materials throughout the world.

Studies in Heat Transmission. By Allan P. Colburn and Olaf A. Hougen. University of Wisconsin, Engineering Experiment Station, Madison, Wis. 158 pages—These studies are referred particularly to tubular gas condensers.

Report on Lac-Refining. By M. Tidance and S. Mahdissan. Published by the Osmania University Press, Hyderabad, Deccan, India, 1930. 10 pages and plates—A good illustrated description of lac manufacture in its rather primitive, oriental form.

Fifty Years of Service to Industry. Pittsburgh Testing Laboratory, Pittsburgh, Pa. 32 pages—Commemorating the fiftieth anniversary of the company's founding, this brochure also describes the facilities and service of the institution.

Chemical Exposition Demonstrates Much New Equipment

ONCE MORE the Exposition of Chemical Industries has come and gone, and this, the thirteenth in the series, which has just closed its doors at the Grand Central Palace in New York City, has brought to light more new developments than any Chemical Show in recent years. This is partly the result of the fact that it is now two years since the last show, whereas the interval has been shorter in the past, with one or two exceptions; but it is more to be credited to slack times, which have necessitated new initiative on the part of equipment makers.

Although the number of exhibitors was slightly smaller than in 1929, and those who were manufacturers of chemicals rather than of equipment had approached closer to the vanishing point than ever before, there were more than a hundred recent developments shown that are worthy of mention. This does not include exhibits of a very considerable number of developments of the past two years that have already been described in *Chem. & Met.* and to which no reference can be made here. It does include all developments that have taken place since the last show, or have first appeared on the market since that time, but have not received notice in these pages. In what follows each of these points will be touched on briefly; and those which require more lengthy treatment will be accorded fuller description in our equipment section in this or a later issue.

For the sake of convenience, equipment has been classified roughly in alphabetical order; but in certain cases where its interest hinges more upon the material from which it is made than on the type of apparatus, it has been listed under the general heading of "Materials of Construction."

Disintegration Equipment — Several newly improved colloid mills were in evidence. Chemicolloid Laboratories, Inc., 44 Whitehall St., New York City, showed a completely new line of mills covering the range of capacity from 5 to 5,000 g.p.h. These machines represent an improved form of the company's older line. U. S. Colloid Mill Co., 11th St. & 44th Ave., Long Island City, N. Y., showed two improved lines of mill. In one, which uses a single rotor, a circulating pump is supplied as part of the machine, and equipped with a bypass to regulate the rate of flow through the mill. Capacity of these mills ranges from 5 to 1,000 g.p.h. An improved double-rotor line, Model CV, uses multiple V-belt drive for the two rotors instead of the direct drive formerly employed. An interesting feature is the "flinger" used instead of packing where the shafts enter the rotor housing. As there is no contact at these points, there is no power absorption and no wear. This construction is said to be entirely leakproof. A third change in the colloid mill field is not a new machine, but a new marketer. Distribution of the British Hurrell mill is now in the hands of the J. H. Day Co., Cincinnati, Ohio.

Other disintegration equipment included a new laboratory model of three-roller mill introduced by the Kent Machine Works, 37 Gold St., Brooklyn, N. Y., and an improved form of the No. 00 screen pulverizer made by Raymond Bros. Impact Pulverizer Co., 1315 North Branch St., Chicago. This machine incorporates a multiplicity of light hammers, a new screw feed, and is adapted for either direct or belt drive.

Dryers—Bowen Research Corp., 117 Liberty St., New York City, showed a recently designed spray mechanism for spray dryers. This is of the turbine type, employing a small rotor of special design, made from any suitable metal. Material is fed into the rotor, which is driven at any desired speed up to 18,000 r.p.m., and discharges as a fine spray around the periphery. The machine is equipped with water-cooled bearings and housing, and is said to be capable of spraying any material that can be forced through a $1\frac{1}{2}$-in. pipe. Another drying development was an improved feeder for the double-drum dryers made by the Buffalo Foundry & Machine Co., Buffalo, N. Y. This is a sort of rotary lock placed in the bottom of a hopper which is fitted with an agitator. It is intended for feeding pasty materials. A final note in connection with dryers is the redesign of the old Gordon-Davis Synchraumatic dryer which is now being built by the Dodge Manufacturing Co. and marketed by the Candler Equipment Corp., 21 East 40th St., New York City.

Evaporators—Buffalo Foundry & Machine Co., Buffalo, N. Y., has developed a new design of vertical-tube vacuum evaporator which is supplied with or without an external circulating pump. As the tubes are placed outside the body of the evaporator, and to one side, very easy cleaning is said to result. Struthers-Wells Co., Warren, Pa., has improved the I.H.V. evaporator which was first shown at the last exposition. The redesign consists mainly in the substitution of a different form of entrainment separator, said to be of higher efficiency.

Fluids Handling—Beach-Russ Co., 50 Church St., New York City, exhibited a new rotary pump adapted to the handling of non-abrasive fluids and pulps. J. P. Devine Manufacturing Co., Mount Vernon, Ill., showed a new motor-driven rotary high-vacuum pump of the oil sealed variety, for process applications requiring a vacuum within 100 microns of absolute. These pumps are available in displacements from 12 to 100 cu.ft. per min. National Lead Co., 111 Broadway, New York City, has taken over the manufacture of a line of submerged lead centrifugal pumps of the type which eliminates the stuffing box through use of a vertical boot around the drive shaft. A small centrifugal pump for laboratory use or application in the plant for small flows up to about 200 g.p.h., was demonstrated by the Resisto Pipe & Valve Co., Cambridge, Mass. This pump is direct-connected to a 1/20-hp. motor. Wicaco Machine Corp., Stenton Ave. & Loudon St., Philadelphia, Pa., had a new precision gear pump for metering viscose to the spinning nozzles in rayon manufacture. Although similar to other gear pumps for this purpose in its general design, it is said to attain an accuracy and longevity not ordinarily associated with the gear pump.

Heat Exchange — Griscom - Russell Co., 285 Madison Ave., New York City, exhibited two very recent heat-exchanger improvements. One was a modification of this company's Tubeflo exchanger, which consists in the substitution of tubes for cast construction. Four tubes are placed parallel and expanded into numerous plates of metal arranged in close proximity to each other. Return bends at one end connect the two hot-fluid and the two cold-fluid passages, while nozzles at the other end serve to introduce and remove the two fluids. A second exchanger unit utilizes a new form of extended surface tube and is intended to be used where one of the fluids is a gas. Instead of employing the usual circular fins, the new tube uses lengthwise fins set in slots and crimped fast around the periphery of the tube.

Penn Grove Manufacturing Co., Grove City, Pa., showed a unique form of heat exchanger, known as the Stamsvik, built like a filter press. It consists of recessed plates of any suitable metal clamped together by means of through bolts and generally sealed with gaskets. Openings through the plates are so arranged that the assembled exchanger consists of a number of thin, substantially circular chambers, separated by thin metal diaphragms. Alternate chambers are in either the hot or cold fluid circuit. Any number of units may be used to obtain the required length of exchanger. A third development in the field of heat exchange was a condenser made by Schutte & Koerting, Philadelphia, Pa., which introduces the innovation of combining the jet and the barometric types to produce a condenser which requires no air pump. Although this development is not quite as recent as most of the others mentioned here, it has not previously been demonstrated at the Chemical Exposition.

Materials Handling—Developed several years ago for use in the fields of mining and metallurgy, a rotary conveyor formerly known as the Jacoby

was shown to chemical engineers for the first time by the Hardinge Company, York, Pa., which has just commenced manufacture of this device. It is a unique form of spiral conveyor, particularly adapted to the handling of hot, dusty, and abrasive materials. The spiral is cast into a shell so that there is no relative motion between the shell and the spiral, and therefore less wear, according to the maker. The tube formed by bolting together any desired number of conveyor sections is supported on tires and these in turn are on carrying rollers. A feature is that any number of feed and discharge points may be provided.

Lewis-Shepard Co., Watertown Station, Boston, Mass., demonstrated a new line of portable cranes in telescopic and non-telescopic, power and hand-operated models. These range in capacity from 500 to 2,000 lb. and in lifts to 14 ft.

Materials of Construction—Grouped under this head are a number of developments that concern chiefly new and improved uses of several of the special construction materials. Apparatus mentioned here is grouped under this head rather than elsewhere because each piece represents an interesting application of a special construction material.

Of the several new uses for fused silica that were shown, perhaps the most interesting was a spherical ground joint for Vitreosil pipes, developed by the Thermal Syndicate, Ltd., 58 Schenectady Ave., Brooklyn, N. Y. Use of the new joint, it is declared, will eliminate the possibility of strains inherent in joints formed by other methods, at the same time preserving a seal, even though there may be some misalignment.

New corrosion- and temperature-resistant paints were shown by the Koppers Products Co., Koppers Building, Pittsburgh, Pa. Among those of interest for the protection of chemical-engineering equipment there was "Lumino," a bituminous-base aluminum paint for temperatures up to 500 deg. F. It is said to have corrosion-resisting and waterproofing properties and to be suitable for use on steel, concrete, and wood. It needs no priming coat. Another paint, "Locomax," is intended for hot surfaces not over 400 deg. F. Acid and alkali resistance is accredited to "Pyrmite," which is said to be suitable for gas holders and similar equipment. "Koppax Black" is recommended for subsoil protection and general utility painting for temperatures to 500 deg.

AMONG new and improved products made from special metals were a number of developments shown by the associated companies of the United States Steel Corp., Pittsburgh, Pa. One was a long length of seamless 18-8 chrome-nickel steel tubing, 8⅝ in. o.d. x ½ in. wall, said to be the largest diameter seamless tube of this material that has thus far been made. Another innovation in 18-8 steel was an exhibit of perforated plates, said to have the finest punchings yet made in this material.

Duriron Co., Dayton, Ohio, showed two new pieces of Duriron equipment and a new Durimet valve with a 45-deg. seat. One piece of Duriron was an improved double-acting reciprocating pump in which the valves consist of cylindrical sections with spherical bottoms. The drive end has been improved. Another Duriron development was an improved exhaust fan which uses a one-piece instead of a split casing.

The only new refractory material noted was a high-temperature bonding material put out by the Quigley Co., 56 West 46th St., New York City, under the name of Mono-Bond. This is mixed with an equal weight of pulverized firebrick or other refractory material and used as a plastic refractory.

Manufacturers of various forms of rubber had a number of interesting innovations to offer. The Wilkinson Process Rubber Sales Corp., 53 West Jackson Blvd., Chicago, showed many samples of a type of rubber which has just recently been introduced into the United States. It is said to be remarkable for its superior resistance to abrasion. The product of this company, known as Linatex, is made without the use of heat in either coagulation or vulcanization, yielding a material said to differ in many details from the rubber produced by conventional methods. By controlling the pH of latex, it is caused to release nascent sulphur. Necessary color and other materials are added while the fluid state still exists. On standing, the mixture coagulates and the coagulum is formed into crepe which, after processing, emerges as a sheet of homogeneous rubber from $\frac{1}{16}$ to 2 or 3 in. thick, as desired. It is claimed that linings produced from this material retain their amorphous condition indefinitely and are affected slightly or not at all by moisture, sunlight, and age. Linatex is recommended by the maker for most abrasion-resisting uses.

In the December, 1930, issue of *Chem. & Met.*, a self-vulcanizing rubber compound known as Covulc, made by the Hitchcock Co., 11 Fayette St., Norfolk Downs, Mass., was described. This was intended for resistance to abrasion, as a covering for conveyor belts, and as a liner for chutes. The company has now developed a modification of this formula which it is recommending for the lining of many sorts of apparatus for protection against acid corrosion. The material is plastic and is applied as a thin coating, after which it undergoes a cold cure within 24 hr. As an example of its use it is said to be immune to attack by hot concentrated HCl at 200 deg. F.

A new hard-rubber valve, one of a line made in sizes to 4 in., was shown by the Resisto Pipe & Valve Co., Cambridge, Mass. One form of this valve is made as a pressure regulator.

B. F. Goodrich Rubber Co., Akron, Ohio, has developed a new "Triflex" rubber lining material consisting of a sandwich of semi-hard rubber between two layers of soft rubber. This is said to give longer life and greater freedom from possible injury than a soft-rubber lining, and at the same time to have none of the disadvantages of the usual hard-rubber lining. Buckling due to large dimensional changes at elevated temperatures is prevented by the use of expansion joints at intervals, the joint consisting of an overlapping of the contiguous ends of hard rubber, with a separation of soft rubber between them. This same company has developed several methods of insulating tanks in which a lining is used to prevent damage to the rubber on account of temperature in excess of 150 deg. F. In one method the rubber-lined tank contains an inner lining of acid-resisting brick, set up in acidproof cement. In another, a wood lining of tongue-and-groove boards, without nails, replaces the brick. In a tank with 4 in. of brick inside the rubber and a temperature of 212 deg. within the tank, the temperature at the rubber is reported to be about 154 deg. F.

GLASS-LINED and glass equipment accounted for several innovations. The Pfaudler Co., Rochester, N. Y., showed three new pieces of glass-lined apparatus. One is a 500-gal. jacketed reaction vessel, with agitator, the last and largest member of the series of standardized kettles announced by the company in 1927. Another piece, an agitated glass-lined tank made in sizes up to 330 gal. capacity, is fitted with a two-speed epicyclic agitator of unique design. A simple shifting of gears suffices to change from one speed to the other. In this device the rotating agitator shaft is set off center and moves continuously in a circle the axis of which is the tank center line. The third vessel is made in sizes to 300 gal. and contains a vertical off-center shaft with push-pull propellers.

Solid glass equipment included a recently developed line of Pyrex glass distillation apparatus made by the Corning Glass Co., Corning, N. Y., and also a number of joints for glass piping developed by this concern. It is now possible to carry out a complete plant-scale distillation in glass. Another interesting piece of glassware was a Pyrex ejector offered by Schutte & Koerting Co., Philadelphia, Pa. This is available in sizes to 2½ in. suction and discharge and 1½ in. steam, for 100 lb. steam pressure. The final new glass development is a sight-flow tube with the necessary fittings and unions, put on the market by the Grinnell Co., Providence, R. I. This is made of Pyrex glass and designed for 150 lb. cold-water pressure with a safety factor of five. These tubes may be used in lines carrying steam and hot liquids.

Continental-Diamond Fibre Co., Newark, Del., exhibited a number of recent developments in molded plastic materials. The company has introduced a line of 1-in. pipe fittings made of Dilecto, a fabric-reinforced, molded phenol-base resinoid material. This same material is used in the production of a new 1-in. centrifugal pump which has no metal in contact with the liquid handled, with the exception of the im-

peller shaft. These products are suitable for acid service. A new resinoid, Dilecto K-4, has been developed for resistance to alkalis. This resinoid is odorless. Another material, known as Codite, is a modified thermoplastic insulating fiber of excellent machining properties, great toughness, and high dielectric value.

STONEWARE manufacturers gave evidence of much activity. General Ceramics Co., 71 West 55th St., New York City, showed a new chemical whiteware called Ceramit, said to be equal or superior to porcelain, and usable for much larger apparatus. This company also exhibited a new automatic acid elevator, claimed to be much simpler than those formerly in use. Other new offerings included an improved armored stoneware centrifugal pump, a ground stoneware roll, a lubricated plug cock, a new and more accurate acidproof brick, a generator for hydrogen sulphide, and an especially heavy type of grinding ball for pebble mills which has been given the name of Baridal.

U. S. Stoneware Co., 50 Church St., New York City, showed a completely new line of ball and pebble mills, the former reinforced with steel. This company has a new line of improved stoneware centrifugal pumps, the impeller shafts of which are protected within the pump by a sillimanite sleeve, and supported outside on a double row of Timken bearings. Other new developments include a new design of lubricated plug valve, a stoneware safety valve, a rotating churn called the Tumble Mixer, a small-sized Vorce electrolytic chlorine cell for laboratory use, a new fast-setting cement for bonding chemical stoneware linings, and a perforated drainer bottom for digesters. This concern has recently taken over the manufacture of A. M. Fairlie's "Hexahelix" packing rings.

Measurement and Control—The Bristol Co., Waterbury, Conn., has developed a new air-operated cycle controller for opening and closing valves or other apparatus through the action of a clock-driven cam on a series of air valves. This company also has a new electric timing device for terminating a process or signaling the operator at some desired time. The company's Type BK control valve has been modified to permit its use for throttling control. The Brown Instrument Co., Philadelphia, Pa., demonstrated a unique type of instrument called a flame analyzer, and used to control the heating effect of a mixture of gases. The instrument consists of a means for supplying gas at a constant rate to a burner which can be very accurately adjusted for flame height. Four small thermocouple junctions are supported at different points in the flame and these are connected so that each pair is in series and the two pairs oppose each other. When the flame characteristics are correct, the net voltage generated is said to be zero. If the mixture is incorrect, the record shown on a calibrated recording pyrometer deviates above or below zero, and this may be used automatically to control the mixing of the gases.

An entirely new type of air-operated controller has been developed by the Foxboro Co., Foxboro, Mass. This is known as the Stabilizer and is intended for controlling temperature, pressure, or flow. The instrument is designed to adjust the correction to the magnitude of the deviation, to bring the variable back to the control point with a minimum of hunting, and to seek the same control point at all times, regardless of whether or not the demand may vary widely. As the property of anticipating is provided for, the controller is said to avoid overshooting to a remarkable degree.

Charles Engelhard, Inc., Chestnut St. and N. J. R.R. Ave., Newark, N. J., has developed three interesting new instruments. The first, known as the Gasalyzer, is a portable thermal-conductivity gas analyzer suitable for a wide range of gases. It may also be used for temperature measurement. The principle of operation is exactly similar to the stationary gas analyzers made by this company. A second instrument, known as a B.t.u. recorder, is designed for determining the calorific value of butane-air mixtures. It is simply a gas analyzer, calibrated in B.t.u. for various butane concentrations. This company has developed an analyzer for testing the exhaust of internal combustion engines. It is intended principally for use in the setting of carburetors.

A very novel form of thermometer was shown by the Liquidometer Corp., Long Island City, N. Y. This is a modification of the mechanism used in the company's standard distant-reading liquid-level gage. The thermometer is of the liquid-filled type, the connecting capillary tube of which is actually a double tube with one capillary blanked off at the thermometer bulb. The two tubes are connected to bellows inside the indicating or recording instrument and these bellows are so linked together that only a temperature change at the bulb will have any effect on the temperature reading of the instrument. Temperature changes along the capillary tube, being the same in both tubes, are canceled out by the bellows linkage. These instruments are designed for a maximum temperature of 350 deg. F., and have a guaranteed accuracy of $\pm$ 1 deg. F. Flexible tubing up to 200 ft. in length is available. This concern also has developed an oil-protected Liquidometer-gage transmitting mechanism for use in tanks containing corrosive liquids.

A new pilot-controlled steam-operated temperature controller has recently been developed by the Sarco Company, 183 Madison Ave., New York City. The temperature system contains a light hydrocarbon, the expansion of which operates the pilot through a flexible expansion element, admitting steam to a diaphragm chamber so as to open the valve against spring pressure.

Minneapolis - Honeywell Regulator Co., Minneapolis, Minn., showed a new "Modulating Motor" for operating control valves, dampers, and other apparatus to produce a correction directly proportional to the deviation of any variable from a fixed point. The valve is controlled by an auxiliary potentiometer circuit which is connected to the detecting mechanism and is unbalanced by any change in the variable. A special circuit located within the motor housing determines the number of revolutions to be made by the motor.

The photo-electric cell is used as the basis of a new measuring instrument exhibited by the American Photoelectric Co., 18th St. & 3d Ave., New York City. A source of light is placed a short distance from a photo-electric cell. After the instrument has been balanced without a specimen, a rebalancing with the specimen placed between the light and the cell indicates the percentage of decrease in light transmission. This may be used for determining certain chemical characteristics as well as the degree of light transmission of the solids or liquids tested.

Richardson Scale Co., Clifton, N. J., has introduced a new sacking scale for the quick packaging of bulk materials. With two operators it is possible to pack from four to seven sacks containing up to 200 lb. per minute. The cut-off is automatic. Another recently developed scale made by this concern is an automatic screw-feed device intended for automatic weighing of cement to be shipped in bulk. A main screw delivers approximately 90 per cent of the desired load to a hopper, whereupon an auxiliary screw delivers the balance more slowly until the scale mechanism causes machine to cut off at the correct weight.

Mixing Equipment — New mixing equipment was evident in considerable variety. Baker-Perkins Co., Saginaw, Mich., introduced a mixer for making viscous materials, such as lacquers, known as the Nitrosolver. This consists of an impeller rotating at high speed and at close clearance within a cylindrical screen. In effect, this is described as a sort of hammer mill which forces gelatinous material at high velocity through the screen. Baker-Perkins also has developed a new packingless shaft seal for its line of mixers for plastic materials. This is particularly adapted to rubber masticators. It is a ground joint which is kept tight by spring pressure.

A NEW portable mixer for small batches was shown by the Kent Machine Works, 39 Gold St., Brooklyn, N. Y. This consists of a propeller and motor mounted on an easily portable floor stand which may be placed alongside of the container of liquid it is desired to mix. Patterson Foundry & Machine Works, East Liverpool, Ohio, has introduced a two-motion mechanism known as the Duplex-Two-Speed agitator. This is of the type consisting of two elements rotating in opposite directions which may have relative speeds of 1-1, 1-2, 1-3, and 1-4. Struthers-Wells Co., Warren, Pa., has developed a new line of liquid mixers consisting of a tank equipped with a high-speed, motor-driven propeller.

An interesting new batch mixer for dry materials is sold under the name of

the MacLellan by the B. F. Gump Co., 431 South Clinton St., Chicago. This consists of a cylinder mounted like a tumbling barrel so as to rotate end over end. The mixer contains a number of partitions radiating from the sides toward the center, separated by an annular V-shaped partition halfway between the ends. As the mixer rotates, materials discharge successively from the various pockets, pyramiding to the other end of the drum and producing a cutting action identical with that used in sampling. It is declared that most mixes can be accomplished completely in one minute. The machine is obtainable in sizes from a laboratory model to one with a capacity of 3,500 lb. per charge.

Packing Equipment and Containers—A new high-velocity packer for semi-fluid products, such as medicinal and cosmetic materials, and certain food products, has been developed by the Karl Kiefer Machine Co., Cincinnati, Ohio. A packer for barrels, consisting of a rapidly vibrating platform, is being manufactured under the name of Vibrox, by the B. F. Gump Co., 431 South Clinton St., Chicago. This machine is supplied complete with motor in both flush and portable models, and in a slightly modified elevated form for packing kegs and cartons. A device for filling the smaller sizes of container with liquids has been put on the market by the Volumeter Co., 710 Ohio St., Buffalo, N. Y. It is known as the Volumeter Junior. It consists of a scale which closes a valve through a mechanical trip when the desired weight has passed into a can placed on the platform. A larger form of this machine uses an electrical trip.

New bags have been brought out by Bemis Bros. Bag Co., 601 South 4th St., St. Louis, Mo. A new dust- and air-tight waterproof bag made of an odorless treated fabric with rubberized seams is adapted to handling materials which must be kept from the air, and where dusting must be avoided. A new pasted-seam fabric bag has been developed for greater strength and for eliminating loss through needle holes. Much greater strength is said to be developed from the same fabric by use of a third new type of bag in which the material is cut on the bias. For sealing paper bags, Saranac Bag Sealers, Inc., Benton Harbor, Mich., has developed a portable general-purpose machine for producing a triple fold and applying staples to light and medium-sized paper bags where leakage loss from the closure must be avoided. The machine is particularly adapted for pigments, dry chemicals, and insecticides.

Sealing of steel containers is facilitated by means of a new mechanism which can be suspended from a chain hoist and which has been developed for loan to its customers by the Wheeling Corrugating Co., Wheeling, W. Va. This is intended for 18-in. open-top containers with closures of the 20-lug type. All lugs are crimped simultaneously.

Power Transmission Machinery—Philadelphia Gear Works, Erie Ave. & G St., Philadelphia, Pa., has introduced a new type of welded cut gear in spur and herringbone types, said to make possible 30 to 50 per cent longer life. Spokes are used in place of the solid web sometimes employed for welded construction. Reeves Pulley Co., Connorsville, Ind., showed a new inclosed variable-speed drive, comprising one of its standard transmissions fitted with a dust-tight inclosure and provided with centralized force-feed lubrication.

Separation Equipment — Tolhurst Machine Works, Troy, N. Y., demonstrated a recently developed centrifugal cleaner for paper stock. The machine is equipped with a solid basket having an open bottom and a feed pipe discharging near the bottom of the basket. Annular baffles on the inside of the basket walls retain a layer of pulp which traps any dirt, while the remainder of the pulp flows upward over a dam and out a discharge casing. This concern has also developed a three-wire-rope suspension for its center-slung centrifugal. Fletcher Works, Glenwood, Ave. & 2d St., Philadelphia, Pa., has adapted the Lewis open-bottom basket to its machines. This is a perforated basket, the lower part of which is slightly tapered toward its open bottom, which is fed from a distributing disk mounted midway on the shaft. A dam at the top holds back the solids until the basket is stopped, whereupon the solids slide out of the open bottom.

A new vertical clarifying filter which operates under pressure and is intended for removing relatively small quantities of solids from large quantities of liquids has been developed by T. Shriver & Co., Harrison, N. J. This consists of a vertical steel casing containing a shaft on which are mounted a number of round filter leaves which rotate between scrapers. Solids are discharged continuously to the conical bottom, where they are drawn off as a thickened sludge. An improved discharge mechanism for the American vacuum filters of its manufacture was shown by Oliver United Filters, Inc., 33 West 42d St., New York City. This consists of two fluted cones, one attached at either side of the disk and rotated at a higher peripheral speed in contact with it. The flutes serve to remove material from the fabric and discharge it into the chutes.

A radically new form of clarifying filter, known as the Laughlin clarifying tank, was exhibited by Filtration Equipment Corp., 350 Madison Ave., New York City. This resembles a thickener in that settled solids are moved to the tank discharge by means of a rake; but the clarified effluent must first pass upward under hydrostatic head through an annular bed of magnetite before it reaches the overflow launder. A rotating cleaning mechanism travels around the magnetite bed continuously. Through the action of an intermittently energized electromagnet, the magnetite particles are lifted periodically, and as they drop through the upward flow of water, dirt is flushed off. The wash water is returned to the intake of the clarifier or it may be discharged to the sewer. In a modified form, known as the Laughlin super thickening tank, the rake and cleaning mechanism are eliminated, but the magnetite filter bed is retained. A cone bottom discharges settled solids through a valve consisting of two fluted rollers in close contact with the casing.

Trouble from the presence of water in solvents or other materials immiscible in water may be eliminated through use of the Aquatrap, developed by Aqua Systems, Inc., 2 Lafayette St., New York City. This consists of a horizontal steel cylinder containing a float-operated inlet valve which is closed when the level of water reaches a predetermined point. The solvent or other material flows continuously through the trap until the quantity of water reaches a dangerous level.

Sifters—The sifting of numerous materials in the presence of conditioned air which may be cleaned, heated, cooled, dried or humidified, is possible with a new air-conditioned sifter shown by the Wolf Co., Chambersburg, Pa. This sifter incorporates the necessary air-conditioning and dust-separation equipment and makes use of a rotating cylindrical screening element. Another sifter shown by this concern, called the Super Sifter, consists of a single- or multi-deck screen supported on a mechanism which imparts a rapid rotary screening motion to it. Construction is said to be entirely dustproof.

Abbé Engineering Co., 50 Church St., New York City, showed a high-speed "turbine" sifter, known as the Blutergess, recently introduced into the United States from France. This machine differs markedly from any other produced in this country and consists of a vertical shaft carrying two turbine-like distributors which throw the material forcibly against encircling screens. The floor space required is very small and the capacity is said to be disproportionately large. The machine is not an air separator and requires no brushes. It is capable of producing products as fine as 300 mesh or even smaller.

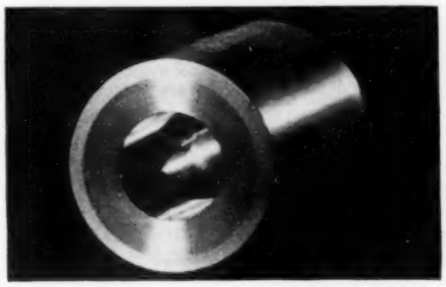
Other Process Equipment—For producing a strong salt brine, principally for use in regenerating zeolite water softeners, International Salt Co., 475 Fifth Ave., New York City, exhibited its newly developed Retsof salt dissolver. This device takes crude rock salt and continuously produces a saturated brine of 25 deg. Bé. It consists of a salt container piped to the water supply by means of a line containing a float valve, the float of which rests in a brine tank. The company is prepared to supply these dissolvers or it will permit its customers to build the machine from its plans without charge.

To increase the safety of inspection of tanks containing flammable liquids, the Volumeter Co., 710 Ohio St., Buffalo, N. Y., is marketing an inspection lamp operated on flashlight batteries. The reflector is connected to the battery case by an extension which contains a mercury switch designed to light the lamp only when it is pointed downward.

EQUIPMENT NEWS
FROM MAKER AND USER

Metal-Lined Tubing

LINING of steel tubing with a variety of metals and alloys by a newly developed method has been announced by the Detroit Seamless Steel Tubes Co., Detroit, Mich. The lining is placed in the tubing by a centrifugal process and, according to the manufacturer, the shell and lining metals are inseparably bonded by fusion, so that no possibility of separation exists. This can be demonstrated by taking a cut with a lathe from one end of the tube, producing a spiral of



Section of Lined Seamless-Steel Tubing

the two metals as one continuous strip without fracture at any point between the two.

Among the various uses suggested for tubing of this sort, the more important are the production of corrosion-resistant linings and of bearings. It is declared that it is possible to use practically any non-ferrous metal or alloy as a lining material. The company is now lining tubes up to 16 ft. in length, in diameters from ½ in. outside to 12 in. outside. It expects later to line even larger tubes.

Filtering Compound

RECENT ANNOUNCEMENT by the Alsop Engineering Corp., 39 West 60th St., New York City, describes a new full-floating asbestos compound for use in gravity asbestos filters. This material is said to be prepared by a new process which is capable of turning out the product at only slightly more than half the former manufacturing cost. This enables the company, according to its announcement, to offer the product at a much lower price than any similar compound on the market.

Tungsten Metal

ADJUSTMENT of certain patent restrictions now permits Fansteel Products Co., North Chicago, Ill., to sell pure tungsten metal in all commercial forms for general purposes. Although this company has manufactured tungsten since 1914, it has previously sold the pure metal only in the form of finished electrical contact points. The metal is now available in the form of bars, sheets, wire, and powder. Tungsten salts also are obtainable.

Automatic Weighing Attachment

ANNOUNCEMENT is made by the Howe Scale Co., Rutland, Vt., of a weighing device for attachment to any beam scale, whereby weighing is accomplished automatically and the exact weight is magnified optically and projected on a piece of ground glass. This device is known as the "Weightograph." It is supplied for the conversion of dial scales, for attachment to beam scales of all types, and in the form of a complete scale. The mechanism consists of a pendulum balancing mechanism which, in rotating to the balance point, moves a transparency carrying the weight figures past a magnifying lens. The lens, cooperating with an electric light, projects the exact weight on a ground-glass window on which a pointer is marked. This eliminates parallax and is said to yield very rapid results with continued accuracy.

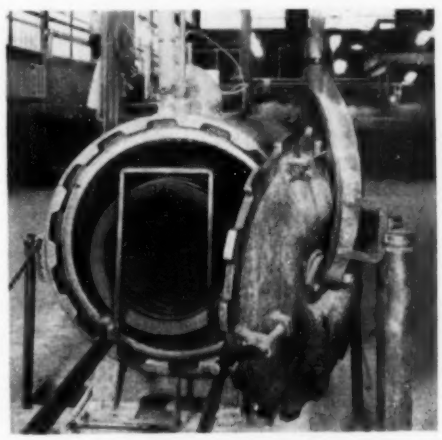
Induction Separator

MAGNETIC SEPARATION of so-called non-magnetic materials is accomplished with a new high-intensity induction separator recently developed by the Magnetic Mfg. Co., Milwaukee, Wis. It is constructed to provide intense magnetic pull with low power input and correspondingly low current consumption. It is adapted for use on such materials as feldspar, dolomite, gypsum rock, glass sand, and similar materials. As appears in the illustration, the separator is flexibly arranged to provide three or more stages of magnetic separation and to give capacity to 10 or more tons per hour, depending on the material being handled.

High-Intensity Induction Separator

Quick-Opening Door

A DOOR originally developed for use on vulcanizers is now being offered by the Blaw-Knox Co., Pittsburgh, Pa., for all other process applications where a quick-opening closure, tight against both pressure and vacuum, is required. An accompanying halftone illustrates the principle of the Adamson door. It is hung by the center from a beam, so as to be easily swung into position, with the lugs on the door moving between the lugs on the frame. The door is then



Adamson Door on a Vulcanizer

pivoted about its center until the door lugs are behind the frame lugs. Turning a valve applies pressure (steam, air, or hydraulic) behind a special gasket which effectively seals the joint according to the manufacturers. To open the door, it is only necessary to relieve the pressure behind the gasket and rotate the door until the lugs are free. As no wedging action is employed, this rotation is said to require very little force.

A second form of door of sliding type also is supplied. In this case, the door is lowered by means of an overhead hoist into a frame which holds it against the gasket described in the preceding paragraph. As above, pressure is applied to the gasket to produce the seal. This type is particularly applicable where floor space is limited. The manufacturers are prepared to supply either

door in diameters from 2 to 10 ft. in any metal specified and for any process vessel. Applications include such equipment as dryers, vulcanizers, impregnating vessels, vacuum tanks, creosoting cylinders, cookers, retorts, autoclaves, and other pressure and vacuum equipment.

Immersion Heater

ELECTRICAL heating elements of the immersion type have recently been put on the market by the Harold E. Trent Co., 439 North 12th St., Philadelphia, Pa. These heating elements are tubular and are said to be interchangeable with other elements of similar character. A terminal head is mounted at one end, together with screw threads for installing the heater in the equipment. Insulation of these units is said to consist of refractory material capable of permitting high temperature while retaining high dielectric characteristics.

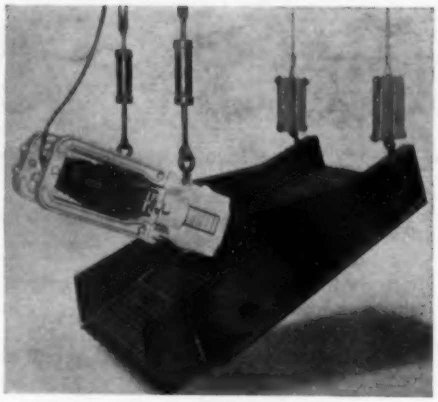
One feature of the device, according to the manufacturer, is the use of the optimum ratio between the areas of the heating element and the outside casing. This is said to result in maximum life of the element. The heaters ordinarily are incased in seamless brass tubing, but bodies of copper, steel, and chrome-alloy steel are also available.

New Vibrating Equipment

CULMINATION of recent experimental work by the Traylor Vibrator Co., 1400 Delgany St., Denver, Colo., has resulted in the development of a method for conveying corrosive solids and pastes in glass and fiber tubes. The principle of operation is exactly similar to that used in this company's vibrating metal-tube conveyor, described on page 704 of the November, 1930, issue of *Chem. & Met.* Several tubes, sufficient to make up the required length of conveyor, are coupled together to form a continuous length of tube. This is supported from a vibrating element, or more than one vibrating element if necessary. The accompanying illustration shows a short length of tubing vibrated in this manner.

The device is said to be applicable for any conveying length and to be suitable for both pastes and pulverized solids. Depending on the material, it will elevate at a maximum angle of about 18 deg. Corrosive liquids may be handled where the conveyor is level.

Experimental Glass-Tube Conveyor for Pastes and Powders



Vibrating and Conveying Screen

A second recent development made by this company is known as the "Conveyanscreen." As appears in the illustration, this is another application of the same vibrating element. Because of the conveying action, the screen can be operated practically flat. The type of support is said to insure isolation of the vibration at the screen. Through control of the small motor-generator set used to supply power, the intensity of vibration may be varied to meet the individual requirements. The screen is furnished in four standard widths and in any lengths necessary to accomplish the duty, in both single and double-deck models.

Improved Carboy Tilter

GREATER SAFETY in carboy handling is said to result from the addition of an improved safety clamp to the carboy tilter made by Schwenk Safety Device Corp., 70 East 45th St., New York City. This tilter will enable one man to handle carboys. The new feature is a grip designed to fasten the tilter to the cleat of the carboy box, and thereby to provide absolute assurance against the carboy slipping or sliding from the tilter. The clamp is adjustable to fit carboys of any size and grips the cleat on all carboy boxes. Three wing nuts fasten the clamp securely to the cleat.

Bellows Steam Trap

QUICK OPENING without wire drawing is said to be attained by a new balanced thermostatic steam trap, introduced by W. H. Nicholson Co., Wilkes-Barre, Pa. The trap is intended for heating and process steam purposes at pressures ranging from zero to 100 lb. The motivating element is a large-diameter bellows suspended at one end from the cover of the trap, and at the other end carrying the valve disk. Pressure inside and outside of the bellows is said to be constant at all steam temperatures and no adjustment is required for any pressure within the operating range. While steam is present, pressure is balanced inside and outside the bellows and the valve is closed. With water in the trap, the temperature is slightly lowered and the internal pressure decreases, while the external pressure remains constant. Hence, the valve opens, discharging the water. The capacity of the trap ranges from 545 lb. per hour at 0 lb. pressure to 7,720 lb. at 100 lb. pressure for the ½-in. trap. Corresponding capacities in the 2-in. size for corresponding pressures are 4,970 and 70,500 lb. per hour.

Slide Comparator

PORTABILITY for ready plant use is a feature of a new slide comparator for hydrogen-ion control, recently announced by W. A. Taylor & Co., 872 Linden Ave., Baltimore, Md. Each comparator covers a pH range of 1.6 and a complete set, the range from 0.2 to 13.6. The comparator consists of a slide and a base. As the apparatus is of molded resinoid material, it is said to be unaffected by exposure to plant conditions. The slide contains seventeen holes for supporting the nine color standards and eight ampoules of distilled water. The base contains two holes for vials of indicator solution, five holes for test tubes, and a closed compartment for a ground-glass plate. This is directly behind the three central test-tube holes.

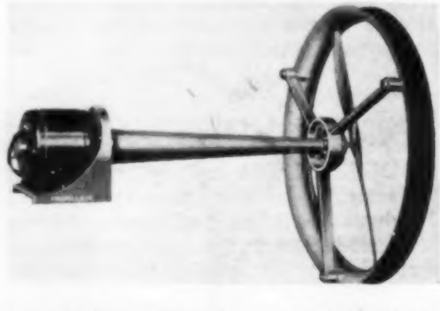
In use the three central test tubes are filled to a mark with the sample to be tested, and indicator solution is added to the central tube. A comparison is obtained by transmitted daylight.

A modification of this instrument known as the long-range slide comparator is made in seven models to cover the range of any three to nine indicators respectively between the limits of pH 0.2 and 13.6. This consists of one complete slide comparator and from two to eight extra color-standard slides, with the necessary auxiliary apparatus, inclosed in a carrying case.

Ventilating Fans

ACCORDING to its recent announcement, Propellair, Inc., 17 South High St., Columbus, Ohio, is marketing a new type of airplane-propeller ventilating fan said to be of very high efficiency. The fan is a development of Prof. A. I. Brown, of Ohio State University. A unique feature of the fan is the curved entrance housing, which is said to make the entire length of the propeller effective. A simpler type of fan than that shown may be installed either in a duct or in a wall. The medi-

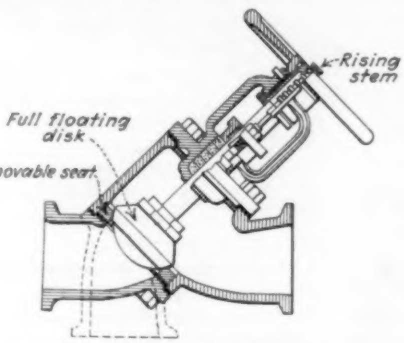
Ventilating Fan With Special Entrance Ring



fied form in the illustration, which was developed for use where it is desired to keep the motor out of the duct, is equipped with an extension on the motor shaft so that the motor may be placed outside an elbow in a duct while the curved housing is installed at the entrance to the elbow.

Alloy-Steel Valves

FOR HANDLING corrosive liquids and gases under conditions of high pressure and high temperature, the Duriron Co., Dayton, Ohio, has developed a new line of alloy steel valves in seven sizes, ranging from ¾ in. to 6 in. These valves are available, made of Durimet or of various chrome-nickel alloys. Construction is shown in the accompanying drawing, from which



Cross-Section of Alloy-Steel Valve With Removable Seat

it is evident that the valve body is of the type in which the seat is supported at an angle of 45 deg. to the pipe axis. The seat is removable and reversible insuring longer life without regrinding. The disk is of the full-floating type and the packing is said to be of special design to prevent creeping of the liquid handled. With the exception of the handwheel, all parts of the valve are constructed of the particular alloy chosen. The ¾-in. valve of this line is not equipped with the removable seat.

New Electrical Equipment

RECENT electrical developments announced by the General Electric Co., Schenectady, N. Y., have included a new line of reversing motors of the single-phase, repulsion-induction type, designated Type SCA. They are available in sizes from ¾ to 5 hp. at 1,800 r.p.m. or ½ to 2 hp. at 1,200 r.p.m. Control consists of a full-voltage, three-pole reversing switch.

A second new motor is adapted to the driving of high-speed rayon pots. It is said to operate successfully at speeds as great as 10,000 r.p.m. Construction is acid-proof, and special design has been used in connection with lubrication, bearings, and the elimination of vibration.

Automatic atomic-hydrogen welding is accomplished with new equipment resulting from still another development. The new welder is designed for longitudinal seam welding of all kinds and consists of a clamping mechanism for holding the work, an automatic travel-carriage, a welding head, and the usual control devices. As the electrodes do not contribute metal to the weld, an auxiliary feeding device feeds the filler rod into the arc. Once the operator has pushed the start button, the striking of the arc, movement of the travel carriage, and length of the arc are all controlled automatically. The method is suitable for the welding of thin metals as well as certain hitherto unweldable metals.

THIS company also is marketing a new heavily coated arc-welding electrode, designated Type R. It is composed of 0.13 to 0.18 carbon steel, covered with a heavy coating of cotton braid impregnated with an arc stabilizing flux. Lengths of 18 in. and diameters from ⅛ to ⅜ in. are available. Because of the protective atmosphere supplied by the coating, metal deposited from this electrode is said to be of high tensile strength and homogeneous structure and to yield a ductile weld. It is said to be of particular value in the welding of pipe lines in the field.

Synchronization of the speeds of non-synchronous electric motors is accomplished by a new control system announced by General Electric. The first application, made at the plant of the Keystone Portland Cement Co., Bath, Pa., synchronizes the speed of the slurry feeder with that of the kiln. Both feeder and kiln motors have speeds adjustable over a wide range. Kiln speed is controlled by the attendant, while the control mechanism automatically adjusts the feeder speed in the desired proportion. This is accomplished through the use of Selsyn generators, mechanically connected to the shafts of the two motors. A Selsyn differential motor has its stator electrically connected to one generator and its rotor to the other. When the generators are in synchronism (at correct relative speed), the differential motor has no tendency to rotate. Any deviation in speed between the two generators will cause the differential motor to rotate forward or backward, depending on conditions, and this rotation actuates a carbon pile resistor connected in the field circuit of the feeder motor. The same system is adapted to many other uses.

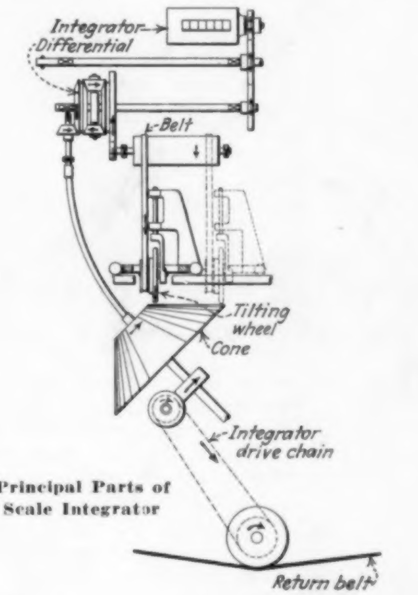
Utility pH Outfit

COMBINATION of its Roulette and Block Comparator types, merged into a much smaller and more compact outfit, has been announced by the La Motte Chemical Products Co., McCormick Building, Baltimore, Md. The new unit covers the pH range 3 to 10.5 with an accuracy of 0.25 pH. It is said that a single determination may be made in 3 minutes with results sufficiently accurate for plant control work.

The Roulette is approximately one-half the size of the company's standard unit. The center revolving portion carries a series of color standards interspersed with ampoules of distilled water. The outer section carries three test tubes of the solution under test, the center one of which contains indicator solution. Comparison is made by artificial light. Current for the light may be obtained from any electric socket. The Block Comparator holds twelve test tubes and a supply of indicator solution. The top section of the block serves in making pH readings, using color standards taken from the Roulette. Its operation is exactly similar in principle to that of the Roulette, except that comparisons are made by daylight. The Block may be readily used by the plant operator, once the central laboratory has designated the proper pH value for the particular process.

Continuous Weigher

WEIGHT of a load moving continuously on a belt may be integrated and, if necessary, recorded by means of the Transportometer, a recent development of the Sintering Machinery Corp., 75 West St., New York City. This machine is of the type in which a section of the conveying belt is supported on floating idlers hung from the scale mechanism. The general design of the lever system is said to follow old established scale practice. The integrating mechanism, however, is of a distinctly new design. Balancing of the



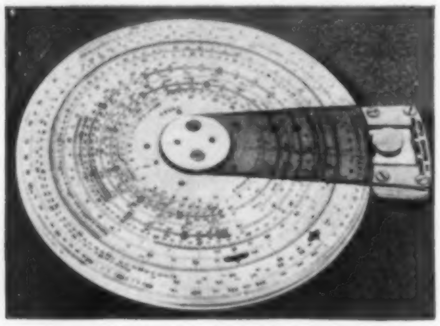
Principal Parts of Scale Integrator

scale is accomplished by means of a float submerged in a mercury vessel.

Operation of the integrator is briefly as follows: A cone pulley is driven by an idler riding on the return belt. A small wheel mounted like a caster rides on the surface of the cone, its position along an element of the cone at any instant being proportional to the position of the scale levers and, consequently, to the instantaneous weight on the belt. The velocity of the small wheel, therefore, is proportional to the instantaneous load. The two rotations of the cone and of the wheel are then compounded by means of a differential gear, and the resultant rotation is conveyed through gearing to the integrating counter.

Where a record of instantaneous

weight is desired, the scale is equipped with a mechanical round-chart position recorder, the pen of which follows the movements of the scale mechanism and records in terms of pounds on the belt.



Fifty-Inch Scales on This Circular Slide Rule

Circular Slide Rule

LONG SCALES are combined with great compactness in a new circular slide rule, the Rotarule, made by J. R. Dempster, 2204 Glen Ave., Berkeley, Calif. The rule is of white celluloid, 5 in. in diameter, and includes all the usual scales. The ordinary A and B scales are 50 in. long, coiled four times around the disks. A set of 13-in. scales is supplied for extremely rapid multiplication and division. The circular construction eliminates the annoyance of "running off the end" experienced with straight rules. Other scales include a log-log scale, an inverted scale, trigonometric scales 17 in. long for all six functions, and other special scales. A magnifier and leather case are manufactured as accessories.

Smoke and Fume Recorder

TO PROVIDE a simple and practical means of continuously measuring and recording the density of smoke or fumes, a recording device has been developed and put on the market by Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. The unit consists of a measuring chamber, a recorder, and, if desired, an indicator. The measuring chamber is installed adjacent to the stack or fume duct with the two sampling pipes shown in the illustration extending into the passage. The smoke or fume is continuously drawn through the apparatus by means of an aspirator. A beam of light is projected across the measuring chamber toward a temperature-compensated thermopile. Heat radiated from the light filament causes a greater or lesser voltage to be generated by the thermopile, depending on the density of smoke or fume. This voltage is recorded in terms of smoke density on a standard L. & N. potentiometer recorder. Should a mechanism for indication be desired, a bank of five colored lamps is used, the color of the light indicating conditions within the stack or duct.

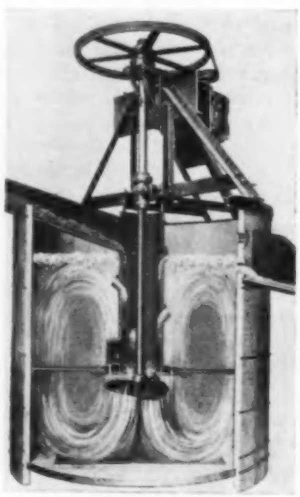
Density Recorder for Smoke and Fumes

Light Chain Hoist

WHAT is said to be the first aluminum alloy chain hoist has been announced by Chisholm-Moore Hoist Corp., Tonawanda, N. Y. This is known as the "Al-Lite." It is said to be one-third lighter than other chain hoists and to have fewer parts, as well as unusual strength and efficiency. Its features include pressure lubrication, a dustproof housing, an adjustable brake, and the use of ball bearings.

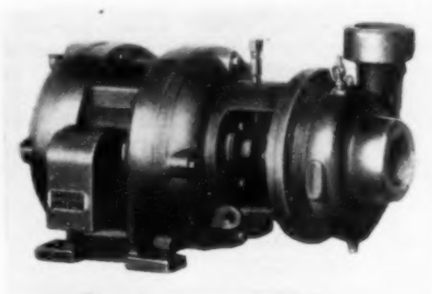
Conditioner and Agitator

VARIOUS KINDS of pulp are handled advantageously, according to the Denver Equipment Co., 1419-17th St., Denver, Colo., in a special form of agitator which this company has recently announced to the chemical industry. Although primarily a metallurgical development, its features are said to make it particularly suitable for many chemical-engineering uses.



Propeller-Operated Agitator

The accompanying illustration shows a cross-sectional view of the new agitator. An upper feed launder drops material into a draft tube placed above a propeller. Rotation of the propeller causes a circulation through the side openings of the tube, down the tube, and out the bottom, as shown in the illustration. If desired, all or part of the intake to the tube can be supplied at a point near the tube bottom, shown closed with a plug. If desired, the top feed can be used at the same time. Where gases are to be introduced simultaneously, they are supplied through a rubber bonnet which connects the lower bearing to the top of the draft tube. A stationary hood over the propeller prevents excessive swirl, reduces friction on the propeller, and is said to prevent choking after a shutdown. The unit is recommended by the manufacturer for the mixing of acid and corrosive materials, as well as the handling of dense pulps. Suitable materials of construction can be used, depending on the application for which the agitator is intended.



"SSU" Pumps Available in Three New Sizes

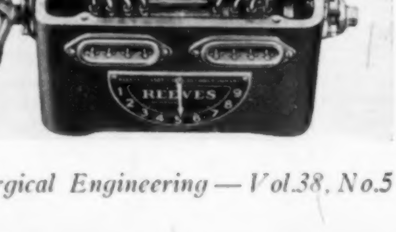
New Pump Sizes

THREE new sizes in its line of "SSU" centrifugal pumping units have been announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis. As shown in the illustration, these are single-shaft two-bearing pumps of the close-coupled type. The line now includes ratings from 30 to 500 g.p.m. for heads under 100 ft.

Inclosed Transmission

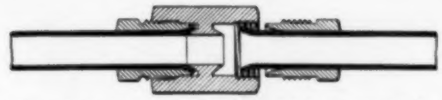
FORCED-FEED lubrication of all bearings is a feature of a new inclosed variable-speed transmission recently announced by the Reeves Pulley Co., Columbus, Ind. The transmission proper is of the company's standard double-cone pulley type. This is provided with a complete closure, guarding the transmission against damage from external sources. Easy access to the operating parts, however, has been provided for. As will be noticed in the illustration, lubrication is accomplished by centralizing the high-pressure nipples at one end of the case. If desired, the motor may be mounted on top of the closure cover.

Inclosed Transmission With Cover Removed



Compression Fittings

LEAKPROOF COUPLING of small industrial and power-plant pipe lines is possible, according to the Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio, through use of the Dieform compression coupling which this company is now marketing in the industrial field. The accompanying drawing shows in section how a tight metal-to-metal joint is made. This does not, however, show how the flare in the tubing is produced. In flaring, the Dieform nut serves as a die and, through the use of a male flaring tool which is supplied, any unskilled laborer is able to produce a perfect swage. The resulting joint is said to be highly resistant to vibration. Fittings are available in brass, Monel, and steel pressures as high as 2,000 lb.



Cross-Section of Metal-to-Metal Coupling

Manufacturers' Latest Publications

Agitator Drive. New England Tank & Tower Co., Everett, Mass.—Catalog 31—24 pages with engineering data on the various types of agitator drives of the "T Series" made by this company.

Chemicals. G. Frederick Smith Chemical Co., 867 McKinley Ave., Columbus, Ohio—58 pages on the uses of perchloric acid.

Construction. United Engineers & Constructors, Inc., 125 E. 46th St., New York—Booklet presenting a large composite drawing of work done by this company during 1930 in construction of plants and other buildings.

Control—Northern Equipment Co., Erie Pa.—16-page booklet on feed-water regulation; also 16-page bulletin describing the control of differential pressure in feed-water regulation.

Coolers. York Ice Machinery Corp., York, Pa.—8-page folder describing a chiller for lubricating and vegetable oils and heavy chemicals.

Disintegration. C. O. Bartlett & Snow Co., Cleveland, Ohio—Bulletin 68—46 pages on crushers, pulverizers and various types of feeder made by this company.

Electrical Equipment. Century Electric Co., 1806 Pine St., St. Louis, Mo.—Bulletin 4-1—Describes fractional horsepower split-phase motors.

Electrical Equipment. Roth Brothers & Co., 1400 W. Adams St., Chicago, Ill.—Bulletin 20-1—Four pages on Century-Roth motor-generator sets.

Electrical Equipment. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Leaflet 20519—Describes new Type HR "Simplex" synchronous motors made by this company.

Electrolytic Pickling. Hanson-Van Winkle-Munning Co., Matawan, N. J.—Eight-page booklet describing the Hanson-Munning Bright-Dip process of electrolytic pickling.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis. — Bulletin 1457-B — 32 pages on rotary kilns, coolers, and dryers made by this company. Includes descriptions, illustrations and data on capacity.

Equipment. Alloy Laboratory Equipment Co., 41 E. 42d St., New York—Catalog "F" 14 G—72 pages describing a complete line of metal laboratory and office furniture.

Equipment. Groen Mfg. Co., 4533 Armitage Ave., Chicago, Ill.—Folder illustrating the range of equipment fabricated by this company.

Filters. Staynew Filter Corp., Rochester, N. Y.—Folder describing air filters for internal combustion engines.

Fittings Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio—Bulletin 13—15 pages on a line of compression fittings for small process piping, now marketed by this company.

Fumigation. J. P. Devine Mfg. Co., Mount Vernon, Ill.—24-page book describing the vacuum fumigation of animal and vegetable products in equipment made by this company.

Fumigation. F. J. Stokes Machine Co., Olney P. O., Philadelphia, Pa.—Eight pages on vacuum fumigating and the equipment for this purpose made by this company.

Heaters. H. O. Swoboda, Inc., 3400 Forbes St., Pittsburgh, Pa.—Bulletin 250—Folder on tubular electric immersion heaters for melting viscous materials.

Heating. Reznor Mfg. Co., Mercer, Pa.—Folders describing a gas-fired warm-air forced-circulation heater, and a heating and ventilating unit made by this company.

Instruments — Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, Ohio—Bulletin 70—Four pages on a new power-type pressure detecting, transmitting and remote indicating device.

Instruments. Bristol Co., Waterbury, Conn.—Catalog 4000—Three booklets totaling 44 pages on air-operated controller equipment, including instruments, valves, and accessories.

Instruments. Brown Instrument Co., Philadelphia, Pa.—Catalog 8008—48-page catalog of instruments for the automatic control of temperature, pressure and flow; also a folder describing a new mercury-contactor indicating pyrometer controller made by this company.

Instruments. The Foxboro Co., Foxboro, Mass.—Bulletin 148-2—32 pages on indicating thermometers; also a 48-page Handbook of Steam-Flow Measurement, by L. K. Spink.

Instruments. C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.—Bulletin 999—17 pages on gas-analysis recorders for boiler plant and industrial applications.

Instruments. Taylor Instrument Cos., Rochester, N. Y.—Catalog Part 1, February, 1931, Edition—84 pages on instruments and control equipment for power plants and other uses.

Insulation. L. Mundet & Son, New York—February, 1931. Price List—16 pages on cork coverings for low-temperature pipe lines.

Materials Handling. Atlas Conveyor Co., 20 S. 15th St., Philadelphia, Pa.—Eight pages on cable power-scraper equipment for the storage of coal and other bulk materials.

Materials Handling. Hardinge Co., York, Pa.—Folder Ah 236—Describes a tubular conveyor now being manufactured by this company.

Materials Handling. Jeffrey Mfg. Co., Columbus, Ohio—Catalog 495—Prices and description on six principal types of spiral conveyor made by this company.

Metals and Alloys. International Nickel Co., 67 Wall St., New York—13-page article on design and construction of heavy equipment in Monel and pure nickel; also includes a collection of advertisements that have been published by users of these metals.

Microscopes. E. Leitz, Inc., 60 E. 10th St., New York—Pamphlet 1182—Illustrates and describes new models of microscope designed for college use. Also Pamphlet 1183, 12 pages on wide-field binocular microscopes.

Mixing. Denver Equipment Co., 1419 17th St., Denver, Colo.—Bulletin 2903-P—20 pages on mixing, pulp density tables, and data on minerals. Describes a pulp-mixing machine for chemical and metallurgical uses.

Ohio Valley. Ohio Valley Industrial Corp., Wheeling, W. Va.—24-page booklet describing the chemical manufacturing advantages of the Ohio Valley industrial district.

Ovens. Freas Thermo-Electric Co., 1206 S. Grove St., Irvington, N. J.—10-page booklet discussing heat transfer in laboratory ovens.

Packing. Metalastic, Inc., Union City, N. J.—Folder describing a new form of coil packing consisting of asbestos particles coated with a metallic covering and supplied with a lubricant.

Paint. U. S. Gutta Percha Paint Co., 19 Dudley St., Providence, R. I.—12-page booklet describing uses of "Barreled Sunlight," a dirt-resisting white paint.

Paint Machinery. Patterson Foundry & Machine Co., East Liverpool, Ohio—Catalog 313—Describes and illustrates this company's line of equipment for paint plants, including grinding and mixing equipment and barrel-cleaning machinery; 32 pages.

Pickling. The Weaver Bros. Co., Adrian, Mich.—Folder describing various sorts of pickling baskets made by this company.

Pipe Tools. The Oster Mfg. Co., Cleveland, Ohio—New general catalog covering this company's complete line of pipe threading tools and machines.

Power Transmission. Foote Bros. Gear & Machine Co., 111 N. Canal St., Chicago, Ill.—Catalog 301—78-page book completely describing and illustrating this company's line of "Hy-Grade" worm-gear reducers.

Power Transmission. Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.—Book No. 1293—Briefly illustrates and describes seven distinct types of positive drive, including chains, gears, speed reducers, and this company's new P.I.V. gear.

Pumps. Allis-Chalmers Mfg. Co., Milwaukee Wis.—Bulletin 1643-A—25 pages with illustrations and engineering data on an improved paper-stock pump.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Specification Sheets W-112-S10 and 11—Covering respectively horizontal duplex-piston oil pumps, Type S.P.; and horizontal duplex-piston heavy-pressure hot-oil pumps, Type S.P.; also Specification Sheet D-423-E8, Vertical triplex single-acting power pumps.

Pyrometer Tubes. Claud S. Gordon Co., 708 W. Madison St., Chicago, Ill.—Leaflet on X-ray inspected metal pyrometer tubes.

Refractories. The Denver Fire Clay Co., Denver, Colo.—Bulletin 144—15-page booklet on high-temperature bonding mortars with descriptions and directions for use.

Regulators. Spence Engineering Co., 110 E. 42d St., New York—Folder of bulletins covering pressure and temperature regulators, pressure control valves, pressure retaining valves, automatic expansion valves, and strainers.

Respirators. Pulmosan Safety Equipment Corp., 167 Johnson St., Brooklyn, N. Y.—Folder describing a wide line of respirators made by this company.

Roofing. H. H. Robertson Co., Grant Bldg., Pittsburgh, Pa.—Several new folders describing this company's recently developed, protected-metal "V-Beam" sheet roofing.

Sanitation. Hardinge Co., York, Pa.—Bulletin 35—18 pages briefly describing installations of clarifiers, digester tanks, sludge pumps, aerators, coagulation units, and dryers made by this company.

Spray Nozzles. Monarch Manufacturing Works, Inc., Salmon and Westmoreland Sts., Philadelphia, Pa.—Catalog 6, Section C—15-page book describing the spray nozzles and regulating valves made by this company.

Spray Nozzles. Schutte & Koerting Co., Philadelphia, Pa.—Bulletin 6-A—32 pages on several types of spray nozzle made by this company.

Steam Generation. Combustion Engineering Corp., 200 Madison Ave., New York—Folder describing a stoker unit for smaller installations made by this company; also nine-page article describing the Kips Bay Station of the New York Steam Corp.

Steam Traps. Sarco Co., 183 Madison Ave., New York—Bulletin 48—Eight pages on thermostatic steam traps for individual trapping systems.

Stock Hydration. Noble & Wood Machine Co., Hoosick Falls, N. Y.—Leaflet describing the "Pre-Hydration System" for paper stock supplied by this company.

Tank Tops. Chicago Bridge & Iron Works, 2128 Old Colony Bldg., Chicago, Ill.—Leaflet describing a new non-sinkable pontoon construction for the Wiggins floating roof for tanks.

Valves. Alloy Steel Products Co., 103 Clayton St., Boston, Mass.—Bulletin announcing and describing a new line of stainless steel valves in gate, globe, angle, and Y patterns.

Valves. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.—Folder describing and illustrating Pretite valves, a new line of quick-opening lever-operated swing-gate valves.

Ventilation. B. F. Sturtevant Co., Hyde Park, Boston, Mass.—Catalog 377—46 pages on unit ventilators for public and private buildings, designed for cleaning, heating, recirculating and replacing air.

Weathering. Atlas Electric Devices Co., 36 W. Superior St., Chicago, Ill.—32-page book describing the accelerated exposure test equipment made by this company; specimens are subjected to artificial sunlight, water spray and refrigeration.

Welding. Gas Products Association, 250 E. Ontario St., Chicago, Ill.—44-page booklet with condensed but complete information on pipe welding. Obtainable from members of the association or from the association office at a price of 50 cents.

X-Rays. St. John X-Ray Service Corp., 505 Fifth Ave., New York—Reprint of an article on technical uses of X-rays.

NEWS *of the* INDUSTRY

Chemical Engineers to Meet in Swampscott

FINAL plans for the 23d semi-annual meeting of the American Institute of Chemical Engineers, which will be held at Swampscott, Mass., June 10-12, reveal an interesting combination of technical papers, plant visits, and social events. Dr. Gustavus J. Esselen, consulting chemical engineer, of Boston, is general chairman, with Prof. W. P. Ryan, of the Massachusetts Institute of Technology, in charge of the program for the technical sessions, which will be held during the mornings of June 10 and 11. A joint meeting with the new Process Division of the American Society of Mechanical Engineers is scheduled for June 12. At that time Clarence Birdseye, general manager of the General Seafoods Co., of Gloucester, will discuss the chemical engineering aspects of the fisheries industry, and E. M. James, mechanical engineer, will present a paper on "The Continuous Centrifuge and Some of Its Applications."

Inspection tours, arranged by Osborne Bezanson, of the Merrimac Chemical Co., will include visits to the soap factory of Lever Brothers, and the laboratories of the Arthur D. Little & Co., in Cambridge, and to the plants of A. C. Lawrence Leather Co., Peabody, Mass., and the Naumkeag Steam Cotton Mills, Salem, Mass. Two especially interesting features are the trips to the General Seafoods Co., at Gloucester, where the visitors will be shown the latest applications of the Birdseye quick-freezing process, and to the plant of the Merrimac Chemical Co., where the contact process of sulphuric-acid manufacture has been highly developed. The design and operation of this plant are to be described by Daniel Dinsmore in a paper before one of the technical sessions.

Other papers will include the following: "The Industrial Development and Opportunities in New England," by G. J. Esselen and W. M. Scott; "The Manufacture of Leather," by W. K. Lewis and R. A. W. Lord; "Chemical Engineering Aspects of the Textile Industries," by R. G. Knowland; "Burning of Pyrites in a Herreshoff Furnace," by F. W. Adams; "Combustion of Pulverized Pyrites," by Horace Freeman. A series of papers from the laboratories of Professors Ryan and McAdams will be presented by T. B. Drew and J. J. Hogan and will be concerned with the mechanism of heat transfer. T. H. Chilton, A. P. Colburn and W. J. King, of the du Pont company, will present three papers on heat transfer and pressure drop in empty, baffled, and packed tubes.

Dr. Arthur D. Little will preside at the formal banquet on June 11, when Dr. Allan Winter Rowe, of the Boston University School of Medicine; Dr. Karl T. Compton, newly elected president of the Massachusetts Institute of Technology; and Dr. John C. Olsen, president of the Institute, will speak. Other social events include a tea at the home of Mr. and Mrs. Frederick S. Bacon in Newton, and beach parties and sports as well as tours to the many points of historic interest in and around Boston. The New Ocean House, which will be the headquarters hotel, will be virtually given over to this meeting.

Safeguards Considered For Sale of Methanol

FOLLOWING the recommendation of the conference of state and territorial health officers recently held in Washington, the Federal Public Health Service is arranging to call a conference with representatives of the methanol industry looking toward the establishment of safeguards surrounding the use of methanol anti-freeze solutions, Dr. Taliaferro Clark, Acting Surgeon General of the Service, said in a letter to Representative Dyer (Rep.), of St. Louis, Mo., made public May 12.

Representative Dyer at the same time made public correspondence between himself and the Surgeon General of the Service, Dr. Hugh S. Cumming, in which Mr. Dyer urged that some steps be taken by the Service looking toward the regulation of methanol, and asking the cooperation of the Service in drafting legislation to that end which he proposes to offer in the next session of Congress.

Dr. Cumming, in his reply to Mr. Dyer, assured him of the Service's interest in the question, and advised him of the fact that the conference of state and territorial health officers would consider it. At the conference, resolutions were adopted asking the Public Health Service to surround the use of methanol with necessary safeguards, and if an agreement between the Service and the industry cannot be reached, that the Service suggest to state officers standard safeguards which the local officers might adopt.

Domestic Potash Output Declined Last Year

POTASH produced in the United States in 1930 amounted to 105,810 short tons of potassium salts, equivalent to 61,270 short tons of potash, according to the U. S. Bureau of Mines. Sales by producers amounted to 98,280 tons of potassium salts, with an equivalent of 56,610 tons of K_2O.

The potash materials of domestic origin, sold by producers in 1930, were valued at $2,986,157 f.o.b. plants. About 20,550 tons of potassium salts with an available content of 10,800 tons of K_2O, remained in producers' stocks Dec. 31, 1930. The output decreased 2 per cent in gross weight, with a decrease of less than 1 per cent of K_2O content. The sales of salts decreased 3 per cent with a decrease of 1.6 per cent in K_2O content. The total value of the sales decreased less than 1 per cent. More crude salts remained in the hands of producers at the end of 1930 than at the end of 1929.

The production was chiefly from natural brines in California and distillery residue from molasses in Maryland. Alunite was shipped from Sulphur, Nev., to California, ground and sold as fertilizer, and a small amount was also produced at Marysvale, Utah, for use in experimental work. Cotton boll ash was also sold as a fertilizer based on its content of water soluble K_2O.

The domestic production figures disclose that no potash in commercial quantities was shipped in 1930 from the newly worked sylvite deposits near Carlsbad, N. M.

Alkali Company to Build Plant in Texas

AT THE close of April it was announced that directors of the Southern Alkali Corp. had authorized the company to exercise the option it held on 350 acres of land at Nueces Bay, two miles distant from Corpus Christi, Tex. The land will be used as a site for a chemical plant which will cost $10,000,000. The plans call for a new ship channel which will be dredged from Corpus Christi Bay to the site of the plant and a new turning basin to accommodate ocean-going steamers. The Southern Alkali Corp. was recently formed by the Pittsburgh Plate Glass Co. and the American Cyanamid Co.

Plastics Symposium Held At Chemical Show

RECOGNIZING the absence of technical associations covering the whole field of plastics and in view of their growing representation at the Chemical Exposition, the magazine *Plastics & Molded Products* organized a series of talks for presentation at the Grand Central Palace, New York City, on May 6 and 7. The large attendance on both days, in spite of the unfavorable lecture facilities, demonstrated an interest in the subject shared by many not directly concerned in the industry.

In the first and technically most interesting talk, B. S. Covell, of Arthur D. Little, Inc., spoke on "Chemicals in the Synthetic Plastics Industry." He described the several groups of compounds, their chemical origin, and indicated their particular problems on that basis. B. C. Budd, of American Insulator Co., then projected his view of the future "Plastics Age," and R. L. Simmonds, of the Celluloid Corp., followed with specifications on cellulose acetate plastics. An illustrated lecture by L. F. Rahm, of Burroughs Engineering Co., showed the progress of the somewhat cumbrous molding technique in the last 20 years, with disappointing emphasis on old rather than the newest methods.

Carl Marx, of Plastics Publications, Inc., gave a general summary of the chemist's part in the history of plastics. Then followed more specific papers by C. S. Lawrence, Jr., of American Plastics Corp., on casein plastics; Leon V. Quigley, Bakelite Corp., on phenolic resinoids; A. J. Norton, General Plastics, Inc., on synthetic resin finishes; C. E. Slaughter, Unyte Corp., on urea plastics developments; A. J. Briggs, General Electric Co., on laminated plastics; and John E. Walker, Pyroxylin Plastics Manufacturers' Association, on nitro-cellulose plastics.

R. C. Gilmore, Jr., chairman of the symposium, arranged to have the papers printed at greater length in future issues of *Plastics & Molded Products.* Definite plans for future symposia have not been laid, but the obvious interest in this first one should encourage its sponsors to meet the need in the future.

Welding Society Elects New Officers

AT ITS annual meeting, held in New York April 22 to 24 inclusive, the American Welding Society elected or reelected as its principal officers: E. A. Doyle, president; F. P. McKibben, senior vice-president; C. A. McCune, treasurer; and M. M. Kelly, secretary-assistant treasurer. Discussion in connection with the 12 papers presented centered largely around the welding of boiler drums and the use of X-ray tests for welds. A proposed piping code occasioned much interest. Preliminary steps were taken toward the incorporation of the society.

President Hoover Praises Chemical Industry

At the Seventh Chemical Industries dinner held in New York, May 7, the following communication, addressed to F. A. Koch, president of the Salesmen's Association, was read before the gathering:

My dear Mr. Koch:

The chemical industries are foremost among those which ally themselves continuously and effectively with workers in science, thereby quickly transforming discoveries of creative research into practical products for human use. To all industries founded upon research, the nation and the world look for the advancement which scientific development makes possible for mankind. The comprehensive gathering on this occasion made up of chemists, engineers, industrialists, and salesmen symbolizes the close bond so desirable in all industry. In your continued progress I wish you success.

Yours faithfully,
HERBERT HOOVER.

Illinois Will Give Gas Engineering Course

A SHORT course in industrial gas engineering will be held at the University of Illinois beginning June 15 and lasting throughout the week. The course is under the direction of the University of Illinois, Prof. D. B. Keyes presiding, and under the auspices of the Illinois Gas Association. This is believed to be the most intensive short course on the subject of industrial gas ever held.

Fertilizer Prices Decline In British Columbia

OWING to the fact that the Consolidated Mining & Smelting Co. is now the dominant factor in the fertilizer situation in the Canadian West, prices of fertilizers in British Columbia have been materially reduced, and chemical fertilizers can now be bought in that province at the lowest price on record. As the Consolidated Mining & Smelting Co. is a subsidiary of the C.P.R., that company has reduced its rates on fertilizers, and similar action has followed on other railways. As a result, freight rates on fertilizers to interior points are now less than was previously the case, but the minimum carload shipments have been increased from 15 to 20 tons per car.

Triple superphosphate running 45 per cent available P_2O_5 and ammonium phosphate running 10 per cent nitrogen and 52 per cent available P_2O_5 are now being produced at Trail. By the middle of the summer officials hope to be producing sulphate of ammonia. By fall they expect to be shipping complete fertilizers from Trail. When this becomes a fact, growers in the interior of British Columbia will have a price advantage on fertilizers over the coast buyers, owing to the cheaper freight haul from Warfield, B. C., which is the shipping point of Trail's $10,000,000 fertilizer plant.

M. I. T. Offers Course In Refining

The department of chemical engineering of the Massachusetts Institute of Technology will offer a special course in refining during the coming summer. This course will extend from July 20 to Aug. 21 and will include detailed studies in the fundamentals of liquid flow and friction, and the second part will deal with heat transmission.

Bakelite Corporation's new plant under construction at Bound Brook, N. J., early this spring. Consisting of six large buildings and nine auxiliary units, it will replace the Perth Amboy plant, which will be shut down this year. Outside construction is now complete, while complete equipment will be installed by the end of summer. Production of resins, varnishes, and molding materials probably will begin in July.

NEWS FROM WASHINGTON

By Paul Wooton

Washington Correspondent of Chem. & Met.

BECAUSE of the fundamental importance of the issue involved, the government is expected to appeal from the decision of Judge Nields, of the U. S. District Court in Delaware, confirming the title of two employees of the Bureau of Standards to patents covering the use of ordinary house-lighting alternating current in the operation of radio receiving sets. The question whether government research experts are entitled to right, title, and interest in discoveries made by them on government time with the use of government facilities and materials has been debated for years.

Government employees who have patented inventions under such circumstances regard Judge Nields' decision as a vindication of their contention, but they expect that, although their ownership will be acknowledged in the future, exploitation of the patents will remain subject to departmental control. They expect to obtain some benefit as a result of the district court's decision, but do not think it will mean that they will receive all the business that may result. The belief is expressed in some quarters that, in order to protect the public interest, the government department or bureau in which the inventor is employed may develop a plan whereby patents are assigned to at least three manufacturers, thus preventing establishment of a monopoly.

At the Bureau of Standards it was stated that its policy must be governed by the outcome of the case in the courts. This policy, as enunciated by Dr. Samuel W. Stratton, first director of the bureau, is that all patents on inventions by members of the bureau's staff shall be dedicated for free, unrestricted use by the public. Under the circumstances on which the Delaware court's decision rests the government retains only the shop rights in the inventions of Francis W. Dunmore and Percival D. Lowell. The former is still a member of the staff of the Bureau of Standards, although the patents have been licensed for use by the Dubilier Condenser Corp.

THE Delaware court's decision is regarded by industrial executives and privately employed scientists as throwing a serious impediment in the path of industrial research. They assert that if the court's decision prevails the taxpayers will be placed in the position of subsidizing government research for the enrichment of private firms and individuals. They hold that the government cannot rightfully compete with industry in financing research for private profit without handicapping private initiative. The chemical industry is much concerned because it is spending several million dollars a month in research, while some of its members are appropriating as high as 20 per cent of their net profits for this purpose.

In dismissing the government's claim to title in the radio patents Judge Nields held that by exercising their skill, knowledge, and experience within the field of work assigned to them the two employees fully performed the duties owing to the bureau. For an employee to go beyond such skill, invoke his inventive genius and make a patentable invention, said the Court, is the unusual and abnormal thing, not the incident to his general employment. The Court recites the argument so long put forward that to withhold the hope of reward from research workers in the Bureau of Standards would crush their inventive genius, drive out of the public service men of unusual qualifications, and lower the bureau's efficiency. The other side of the argument is that if a research worker is paid by the taxpayer, he is working for the taxpayer and not for himself, although he may profit eventually by building up a reputation for himself while in government service.

IN THE discovery of a new process of production, zinc just recently got the first news break since zinc smelting was originated by the Chinese before 600 A.D. This process, which employs methane or natural gas as a reducing agent, is the invention of Charles G. Maier, metallurgist at the Berkeley (Calif.) experiment station of the U. S. Bureau of Mines. Great significance attaches to Mr. Maier's method, as it anticipates the recovery of zinc from low-grade ore not heretofore regarded as commercially useful.

In view of the diminishing profit from zinc production, the advent of the new process is timely, but the news was received with some foreboding in the industry, because it forces a new departure at a time when it can ill afford to bear the expense of a new installation. That is one viewpoint. The other is that the methane process holds forth the promise of salvation to the man who is producing zinc and zinc only. He is distressed by a price forced down by byproduct zinc. The Maier process offers him an opportunity to produce a low-price metal by removing the complication caused by the occurrence, principally in the Tri-State field, of both zinc and lead in the ore body. This producer now has to choose between adopting the new process and letting his present plant stand idle.

Recent improvements in metallurgy require higher grades of zinc. Formerly prime Western spelter was the standard of quality, but now the stage has been reached where electrolytic zinc of 99.99 per cent purity is the standard. The new process is expected, according to the Bureau of Mines, to produce zinc fully as pure as any commercially available today at a fraction of the present cost. By this process natural gas, as a seven billion dollar commodity, may advantageously employ some of its immense capacity to the economic benefit of the country's third largest non-ferrous mineral industry. Fuel economy is high. In present practice one ton of coal is required to produce one ton of metallic zinc. In the new process 12,000 cu.ft. of methane, at 10c. per thousand, accomplishes the same purpose and thus is equivalent to coal at $1.20 per ton.

DIRECT smelting of zinc to liquid metal, the goal of the zinc metallurgist, is accomplished by the Maier process. It follows three years of experimental study by the Bureau of Mines to determine if zinc-smelting costs could be reduced and high quality maintained. Thermodynamic calculations made at Berkeley enabled the prediction of the chemical combination of zinc oxide from the ore and of methane or natural gas at a certain temperature. This degree of heat, 900 to 1,000 deg. C., is from 300 to 500 deg. less than that required by present methods and consequently contributes much economy in plant construction and operation. These and other advantages of low maintenance and labor costs, high recovery and quality of product, are the practical benefits realized in the Maier process.

In permitting importation of nitrogenous fertilizers only by special license, it is assumed in Washington that France is attempting to protect home industry. The French government's nitrate plant at Toulouse is something of the same white elephant as Muscle Shoals. The decree became effective May 8 and applies to all shipments cleared for France on and after May 7 of ammonium sulphate, mixed or not with ammonium nitrate; natural and synthetic sodium nitrate; calcium nitrate; and calcium cyanamide. Import licenses will be issued under the direction of the French Ministry of Agriculture.

The annual meeting of the Manufacturing Chemists' Association will be held at the Seaview Golf Club, Absecon, N. J., June 4-5. After the regular business session on June 4, Dr. William J. Hale, director of organic research of the Dow Chemical Co., will discuss the contribution that chemistry is making to economic progress as demonstrated in the past and promised in the future. Senator Henry D. Hatfield, of West Virginia, will address the joint dinner meeting of the Manufacturing Chemists' Association and the Synthetic Organic Chemical Manufacturers' Association.

That attempts to regulate the sale and distribution of methanol are making headway may be seen from the fact that the Federal Public Health Service has invited members of the methanol industry to a conference to discuss measures directed toward safeguarding the commerce in methanol with special reference to its use as an anti-freeze.

British Chemical Companies Show Favorable Financial Returns

Profits Relatively Larger Than Those of Other Basic Industries

From Our London Correspondent

TAKEN AS a whole, financial returns on capital invested in chemical industry show up well in comparison with other basic industries. The outstanding feature is the annual report of Imperial Chemical Industries, the gross profit being about $25,000,000. The decrease in net profit was only $6,500,000 without allowing for profits realized on the sale of investments, which latter were added to general reserve now standing at the respectable total of $85,000,000 against issued capital of rather more than four times that sum. The dividend on the ordinary shares is reduced from 8 per cent to 6 per cent and some $10,000,000 was expended out of profits in maintaining manufacturing facilities in a high state of operating efficiency.

The directors are of opinion that the nitrogen industry will ultimately come into its own and that therefore the burden of Billingham can be satisfactorily shouldered for the time being. This will no doubt depend upon the terms for renewal of the international nitrogen cartel and possibly the relative failure of the Cosach capital issue will ultimately prove helpful. Another encouraging factor is the admission of I.C.I. into the International Hydrogenation Patent Co. and the persistent rumors that valuable technical and commercial progress in the production of oil from coal has been attained at Billingham. On the other hand, it is rumored that startling results in this connection have been obtained in Japan by hydrogenation and also in this country by low-temperature carbonization, so that further news will be awaited with particular interest.

It is only natural that at such a time there should be considerable reduction in staff and a temporary modification in the policy originally decided upon in regard to future research. For this and other reasons the time has perhaps been badly chosen for the Institute of Chemistry to propose an extension of its royal charter by which it seeks for its own members the sole right to use the title "Chartered Chemist." There is considerable controversy over this both within and outside the institute, chiefly because the use of the title will depend upon the continuance of the annual subscription, whereas one's natural instinct is to say "once a chartered chemist always a chartered chemist" if the title is merely to be a hallmark indicating the owner's scientific and technical attainments.

Turning to dyestuffs, it is of interest to note the absorption of the old-established British Alizarine Co. by I.C.I. The former concern was established in 1882 by the turkey-red dyers of the country to safeguard their own supplies of alizarine. The merger will no doubt strengthen the position of the industry as a whole and help to pave the way for the crisis which may arise when the Dyestuffs Act is due to expire next January.

The British Dyestuffs Corp. announces a new grass green color, Duratol Green G, being one of the so-called "ice colors" and this probably is one of the results of the work done and the advantages obtained in connection with the litigation last year over the Naphthol A.S. series in which I.C.I. proved successful. Undue prominence was given in the technical press to this discovery, and to place it on a level with Caledon jade green was obviously an unnecessary exaggeration, defeating to some extent the prominence and advertising value otherwise obtainable.

The balance sheet of the Chemical & Metallurgical Corp., Ltd. shows that this concern may, thanks to drastic proposed capital reorganization, ultimately find a reasonably profitable scope in the heavy chemical industry. The differences between the company and its former managing director have been amicably settled and although the company is operating at only half capacity, the accounts practically break even. A great deal of capital has of course been lost, particularly in the costly metallurgical plant installation.

Edwin Thompson, Lord Mayor of Liverpool, who arrived in New York for a visit of this country on May 5, is also vice-president of the British Society of Chemical Industry, and used the opportunity to see the Chemical Exposition in progress.

THE report of the Departmental Committee on the Patents and Designs Act and on the practice of the British Patent Office has just been published as the result of two years' work by an unusually competent and representative body of men. The committee decided against the idea of short-term patents and also against the proposal that medical patents should be public property. As previously mentioned in these notes, there was a considerable body of opinion both on moral and economic grounds against the latter proposal. On the whole the committee finds that the British patent system has been developing on sound lines, but recommends an extension of the area of the official search formality, and that it be limited to particular cases and when directed by the Comptroller of the Patent Office. The inventor should be protected further against groundless threats of legal proceedings, and conversely it is proposed to protect the public by hampering the inventor in any attempt to make his claims embrace a wider field for his invention than is justified.

The opening near London by the Mond Nickel Co. of a special refinery for precious metals is of considerable significance. Originally started seven years ago, it has now been found desirable to provide for the centralized working up of residues from various subsidiary companies and including platinum concentrate from South Africa and Canada. The future yields of the factory probably will be 40 per cent platinum, 40 per cent palladium, 13 per cent of gold, while the remainder will comprise rhodium, ruthenium, osmium, and iridium. The planned capacity is 300,000 oz. of platinum annually.

It is particularly interesting to note that the use of palladium is regarded as having a hopeful future, partly for dental work and spectacle frames, and mainly in connection with the new process of palladium plating which may even find extensive application in the protection of silver articles against tarnishing.

A paper recently read before the Institute of Fuel on the petrographic treatment of coal, may prove of more than usual interest and importance. The paper was very voluminous but the gist of it was that the technical separation of coal into vitrain, clarain, durain, and fusain is possible by elastic percussion in pendulum mills, after preliminary dry dressing where the ash content of coal is high. Although complete separation is not possible, the process may be of considerable importance to countries deficient in high-grade bituminous and coking coals, but rich in non-coking coals of high volatile content. The Lehmann process, as it is called, has been operating experimentally in Germany for some time, and experimental work on British coal is likely to follow almost immediately.

France Increases Consumption of Potash Salts

Output of Mines Ten Times That Of Prewar Years

From Our Paris Correspondent

WE HAVE mentioned in a previous letter that the use of potash as a fertilizer has considerably increased in France. The following figures will clearly indorse our statement: in 1919, 60,000 tons of pure potash was consumed; in 1929, 240,000 tons. This considerable increase in ten years is mostly due to the efficient advertising methods of the Alsatian potash mines of France and the Kali Sainte Thérèse Co., an independant Franco-Alsatian company even before the war and the return of Alsace to France. Both concerns are quite independent of each other; nevertheless they transact business through a common agent, the Alsatian Potash Mines Commercial Co. This firm has numerous branches and storehouses scattered all over France. Quite recently another potash producing firm has been formed, the Blodelsheim Potash Mines Co., which is actually sinking two mine shafts and probably will be in working order in two years' time.

At present the yearly output of potash is ten times larger than it was in prewar days; last year 3,133,815 tons of raw salts was extracted (2,133,000 tons by the state mines and 1,002,000 tons by the Kali Sainte Thérèse Co.). About 10,500 miners are employed, mostly Poles and Czechoslovaks. Only part of the raw potash salts are refined and concentrated before use. This refining process is done by the Bollwiller and Ensisheim Works, which can treat daily 1,500 tons of raw sylvinite. Another refining factory is now being built by the Kali Sainte Thérèse Co. The new works will concentrate 4,000 tons of potassium chloride daily. Other works also will manufacture potassium sulphite, for which there is a demand in agricultural circles. Potassium, it is known, is one of the active agents of new fertilizers, such as potazote, nitrate of potassium, and other similar products.

The same firms have also built factories to manufacture bromine. The proportion of bromine per ton of sylvinite is 1 kilo 200 grams. In 1930 the yearly output reached 500 tons, against 300 tons the year before, the state mines producing 300 tons and the Kali Sainte Thérèse the remaining 200 tons. Both works could supply about double this quantity, but there is no demand for such an output. Bromine is used mainly in the manufacturing of coloring matters, chemical and pharmaceutical products, and photographic products. Lead tetraethyl is not used in France in addition to gasoline, as it is considered unhealthy to handle, and other anti-knock agents are being considered.

About one-half of the Alsatian potash produced is consumed by the home market, the other half being exported by transport along the Rhine to Antwerp. In 1929, over 600,000 tons of potassium salts was exported through Antwerp.

Unfortunately, the Antwerp harbor cannot deal with larger quantities and in spite of the Belgian government's intervention and protest the Alsatian Potash Co. has made another agreement with the Dutch harbor of Rotterdam, on a basis almost similar to the agreement drawn with Antwerp. Another 600,000 tons of potassium salts will therefore pass in the near future through Rotterdam.

The present output of the potash mines of Alsace will certainly be increased if the 1930 output is not larger than the 1929 output; it is merely because present business conditions are bad and a larger production is therefore undesirable. Steps are being taken, however, to increase the extraction of potash and endeavors are being made for a greater consumption of potash and its byproducts by the chemical trade, which now takes only 5 per cent of the general consumption.

THE World War gave the aluminum trade a tremendous boom. In 1915 the world's aluminum output was 68,000 tons; in 1929 it reached 265,000 tons. American and Canadian aluminum surpassing European aluminum in quantity. The European aluminum producers have united in a trust whose policy is to manufacture aluminum at the cheapest price possible. In a few months this trust will come to an end if the present agreements are not renewed, which is most unlikely, in spite of the slight friction between two members of the trust.

In France about 90 per cent of the aluminum made is manufactured by the Pechiney-Ugine Union, 10 per cent being manufactured by the French Aluminum Co. The Duralumin Co. also manufactures an aluminum alloy. The Pechiney-Ugine Union has nine factories in France, all well equipped and modern. The newest is the Sabard works especially equipped for the manufacture of chlorates for the making of aluminum. The Pechiney-Ugine Union also has investments in Norway, Spain, and Russia, where it has not only invested capital but gives technical advice.

The Pechiney-Ugine Union has just created a new company for the manufacture of magnesium, hitherto manufactured only in small quantities in France by the Ugine works. The process used is the electrolysis of magnesium chloride, a byproduct extracted from the salt of the sea. The Pechiney-Ugine Union has equipped part of the Berresea, a lake near Marseilles, for this industry.

Mellon Brothers Receive Chemists' Medal

AT A LUNCHEON of the American Institute of Chemists held in Washington, May 9, the yearly medal of the institute was presented to Andrew W. Mellon, Secretary of the Treasury, and to his brother Richard B. Mellon, of Pittsburgh, "for noteworthy and outstanding service to the science of chemistry and the profession of chemist in America." Dr. Frederick E. Breithut, president of the institute, delivered the presentation address. He referred to Secretary Mellon and Richard Mellon as two great chemical engineers who established the Mellon Institute of Industrial Research sixteen years ago, when chemistry was regarded by most industrialists as a stepchild, rather than blood relation.

"Though the United States is, primarily, an industrial nation," he stated, "it is a sad commentary on our lack of appreciation of scientific research that the Mellon Institute of Scientific Research is the only institute of its kind in the whole country."

In accepting the medal in behalf of his brother and himself, Secretary Mellon said: "I cannot let this opportunity pass without a reference to Robert Kennedy Duncan, who introduced my brother and me to the limitless possibilities of scientific investigation, particularly in the field of chemistry and chemical engineering, as applied to the development of industry. Dr. Duncan was one of the pioneers in industrial research, and the system of industrial fellowships, which he evolved and which has been further developed by his worthy successor, Dr. Weidlin, has furnished a practical method of placing scientific investigation at the service of business and industry."

Leather Chemists to Meet In Atlantic City

THE twenty-eighth annual convention of the American Leather Chemists' Association will be held at Atlantic City May 27-29. Headquarters will be at the Traymore Hotel. Two papers will be presented by Dr. E. R. Theis and his associates at Lehigh University. One will be based on a study of liming and depilation; the other on the pickling process. Dr. Karl Freudenberg, professor of chemistry at Heidelberg University, Germany, will deliver an address in which he is expected to discuss the results of research work in connection with the use of vegetable tannins. Four papers will be presented by the research laboratory of the Tanners' Council under the direction of Dr. F. O. O'Flaherty.

German Industry Active Despite Economic Pressure

Plans Made for First Large Oil Refinery in Germany

From Our Berlin Correspondent

ECONOMIC conditions continue to be almost entirely unsatisfactory, slight improvements being traceable to seasonal influences. Although official statistics indicate higher exports than imports, the latter consist mainly of raw materials, which have suffered a great price decline, so that in order to arrive at a comparison with past years one must double the import figures. Exports consist mainly of manufactured goods, which have displayed no decline in prices, for the constantly increasing social and tax burden does not allow any major price reduction without grave danger to all industry. That is also the reason why Russian dumping in an increasing number of goods cannot be coped with any longer without resorting to radical measures, as in other countries; for Germany this would be a double-edged sword, due to her widespread economic ties with Russia.

The consistently favorable notices received from German oil properties in Hannover and Thuringia have aroused a slight oil fever, which is dampened, however, by the constant reduction in price of petroleum products. Nevertheless, the entrance of the German potash industries, especially Wintershall, into the active participants has stimulated the erection of the first large German refinery. The firm of McKee will construct this in Miesburg, Hannover, where it will install by the Dubbs cracking process. It will receive ample protection through the tariff on foreign crude petroleum, which has hitherto prevented the growth of a refining industry in Germany, but it is further favored by a contract which the German Reichspost has closed for ten years with the operators (Preussische Bergwerke Hütten A.G. and Gewerkscheft Elverath). It will go in operation within a year. The sources are judged by experts to run to 300,000 tons annually, whereas up to 180,000 tons is now being produced.

IN this connection it may be interesting to note that the Junkers Co. has succeeded in constructing a motor running on crude oil. Successful trials have been made at Dessau and it is expected that the new fuel (heavy oils are mainly concerned) will eliminate fire hazards and increase the flying radius of the machine.

Electrochemical oxidation of paraffins has recently been undertaken by I. A. Atonasiu. He found that they are easy to oxidize at the anode by the use of a catalyzer such as calcium bichromate, but even better with cerium sulphate. The yield, besides gases and unsaponifiable products, is mainly fatty acid, being larger in the case of hard paraffins but quicker in the case of soft.

The production of illuminating and fuel gas from lignite seems at last to have been solved in Kassel after four years of research. The gas generated at the experimental plant of the Braunkohle-Gas G.m.b.H., Berlin, on the property of the Municipal Gas Works in Kassel, is equal in every respect to gas from coal. Already more than one million cubic meters has been introduced into the city lines without causing any difficulties whatever to the consumers. The plant is to be increased to an annual production of three to four million cubic meters. The advantages of this operation are low purchase and transport costs for the raw lignite, 50 to 200 per cent higher gas yield than with coal, corresponding to the decrease in byproduct. The necessary heat for operation is generated by lignite coke, and the gas must be purified before consumption.

Long-distance supply of gas is making rapid progress in Germany. In the Ruhr district 34,000,000 tons of coke—that is, 89 per cent of the total production in Germany—is produced. The generated gas is mainly consumed by the industries in the Rhenish-Westfalian district. This amounts to about four billion cubic meters, as much as the total production of all German gas works, and the remaining six billion cubic meters is used mainly in underfiring the coke ovens themselves. The outside sales will be increased within the next few months and probably total 550 million cubic meters for 1931. The price for the recaptured sulphur in the cleansing operation is low; hence new means of exploitation are being tried. At present this source of sulphur has cut the national imports in half.

A NEW process for generating hydrogen-nitrogen mixture consists of cracking coke gas—i.e., methane—with steam and air over nickel catalyzers at about 1,000 deg. C. The cracked gas containing hydrogen, CO, and nitrogen, is passed over dolomite at about 500 deg. where the carbon monoxide is retained by the dolomite. The resulting gas (called synthesis gas) is a mixture containing 35 per cent nitrogen. The cost for a large installation yielding 10,000 cu.m. of mixed gas a day, yielding 70 tons of fixed nitrogen daily, or 30,000 tons of ammonia a year, are claimed to be 2.8 pf. per cubic meter of the mixture at a price of 1.5 pf. for coke gas, while pure hydrogen costs from 3.4 to 3.7 pf. These experiments, made by W. Gludt and his associates, are also applied to natural gas, which at a price of 1 pf. per cubic meter yielded synthesis gas at 1.93 pf. The process is being operated by the Gesellschaft für Kohlentechnik.

The new non-shatterable glass known as Luglas, made by the Röhm & Haas Co. at Darmstadt, reported in the November issue, uses a synthetic condensation product which is so elastic that a strip can be pulled to ten times its length and returns to its original state. It is also said to be extremely light-fast to the sun.

CALENDAR

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Swampscott, Mass., June 10-12, 1931.

AMERICAN CHEMICAL SOCIETY, 82d meeting, Buffalo, N. Y., Aug. 31-Sept. 4.

AMERICAN GAS ASSOCIATION, annual chemical conference, Philadelphia, May 20-22.

AMERICAN LEATHER CHEMISTS' ASSOCIATION, Atlantic City, May 27-29.

AMERICAN REFRACTORIES INSTITUTE, spring meeting, White Sulphur Springs, W. Va., May 25-26.

AMERICAN SOCIETY FOR TESTING MATERIALS, Chicago, June 22-26.

ELECTROCHEMICAL SOCIETY, fall meeting, Salt Lake City, Utah, Sept. 2-5.

THIRD INTERNATIONAL CONFERENCE ON BITUMINOUS COAL, Pittsburgh, Nov. 16-21.

New York Electrochemists Will Hold Meeting

THE next meeting of the New York section of the Electrochemical Society will be held on Friday evening, May 22, at the Westinghouse Lighting Institute, at Grand Central Palace, New York City. The program consists of a talk by Dr. A. Brann, of the engineering department, Westinghouse Lamp Co., on "The Chemistry of the Incandescent Lamp," and an address by Mr. Dudley Willcox, treasurer and assistant manager of the Ajax Electrothermic Corp., on "Recent Coreless Induction Furnace Developments." After the meeting, the "City of Light" of the Westinghouse Lighting Institute will be exhibited. Ladies are invited.

Du Pont Acquires Control Of Alcohol Company

ANNOUNCEMENT has been made that E. I. du Pont de Nemours & Co. has purchased the one-half interest in the Eastern Alcohol Corp. formerly held by the Dunbar Molasses Corp., a subsidiary of United Molasses, Ltd., of England. The Eastern Alcohol Corp. was formed in 1925 with the du Pont company owning one-half of it. The plant of the corporation is at Deepwater Point, N. J.

MEN IN CHEMICAL ENGINEERING

MORTIMER J. BROWN was elected vice-president of the Roessler & Hasslacher Chemical Co., New York City, at its recent annual meeting. Dr. Brown will be located at the Niagara Falls plant, where he joined the company as chemist in 1911 after leaving Cornell University. He was transferred to Perth Amboy in 1917 and to California in 1919, returning to Niagara Falls in 1923, where he was made general superintendent three years later.

R. M. BURNS, of the chemical section of the Bell Telephone Laboratories, New York City, was elected treasurer of the Electrochemical Society for the coming year at the meeting in Birmingham in April. Dr. Burns, who has long been active in the society's affairs, is in charge of electrochemical research at the Bell Telephone Laboratories.

ROGER CHEW, director and member of the executive committee of the Standard Oil Development Co. since 1927, has retired from active work because of recurring attacks of ill-health. Mr. Chew joined the Standard Oil Co. on its engineering staff at Bayonne in 1897, whence he passed successively through the chemical laboratory, the refinery, and the inspection department. In 1922 he became technologist for the Standard Oil Development Co. and later of the manufacturing department.

JAMES W. MCBAIN, professor of chemistry at Stanford University, California, is leaving for Europe on May 23, after completing work on a new book.

W. E. CLIFFORD, who left for Russia early in 1930, to take charge of wood distillation plants there, terminated his connection and now is sojourning in Toronto before taking up new duties.

JAMES F. WALSH, who resigned as vice-president of the Celluloid Corp. early this year, has joined the consulting staff of Arthur D. Little, Inc., Cambridge, Mass., after returning from a vacation. Mr. Walsh, who has been with the Celluloid Corp. for eleven years, was previously with the Otis Elevator Co., Borden Milk Co., General Electric Co., and during the War with the Chemical Warfare Service.

E. A. RYKENBOER has been appointed vice-president of the Roessler & Hasslacher Chemical Co. after 13 years at the Niagara Falls plant, of which he became general superintendent in 1929.

ROBERT E. WILSON, director of research of Standard Oil Co. (Indiana), has been elected to the board of directors of the company, and is now the third chemically trained member on the new board.

FELIX STAPLETON, P. K. LAWRENCE, and R. M. LAWRENCE have joined the staff of the chemical division, U. S. Tariff Commission, at Washington in its reorganization under Dexter North, the new chief.

L. S. FRYER, formerly with the DuPont Rayon Co. at Buffalo and later with the Acme Rayon Co., has become assistant to vice-president and general manager of the Industrial Rayon Co. at Cleveland.

THEODORE MARVIN has been appointed advertising manager of Hercules Powder Co. to fill the post left vacant by the death of Nelson G. Greensfelder. Mr. Marvin, who has been with the company for eight years, was graduated from the Colorado School of Mines, then joined the staff of *The Explosives Engineer* and in 1925 became its editor.

OBITUARY

STEWART W. YOUNG, since 1899 professor of physical chemistry at Stanford University, died of pneumonia on April 19, at his home near Palo Alto, Calif. Prof. Young's career included work on tin compounds, recovery of sulphur from smelter fumes, on copper sulphide ores, and petroleum and shales.

HARRY F. NOYES, vice-president of the Victor Chemical Works, Chicago, died in New York City on May 8 at the age of 48. Mr. Noyes was in town to visit the Chemical Exposition and was found dead in his hotel room.

E. H. ROTHERT, long active in chemical and metallurgical practice in the Northwest, died on April 2 at Seattle, Wash., after a breakdown. Dr. Rothert was educated in Ohio, and subsequently opened a laboratory at Cincinnati, where a problem on titaniferous ore reduction generated his life-long interest in titanium. In 1904 Dr. Rothert began work on the Pacific Coast and erected several plants for experiment and about 1916 he produced some steel in an electric furnace and later applied the electric furnace to production of alloy steels.

EDWARD P. CAMERON, director of the division of pulp and paper of the Forest Products Laboratories of Canada, died at Montreal on May 12, at the age of 38. A graduate in chemical engineering at McGill University, Mr. Cameron entered the government service in 1920 and, as a result of his activities in the pulp and paper division, developed the idea of a research institute for the whole industry.

THOMAS T. GRAY, president of the Gray Laboratories, of Newark, N. J., and leading petroleum technologist, died of pneumonia on April 29 at his home in Elizabeth, at the age of 50. Mr. Gray came of a large family of petroleum technologists, including his father and six brothers. He was born in Franklin, Pa., and studied at Columbia University, entering the petroleum industry soon afterward. He was chief chemist of the Tide Water Oil Co. from 1903 to 1915, but also carried on private research and consulting work. Although his inventions covered an extremely wide field, his name is especially associated with the first successful vapor-phase gasoline refining process. This was discovered in 1913, but not put in full-scale operation until 1924 at Barnsdall, Okla. In 1918 he organized the Gray Laboratories, in which several of his brothers have participated. Mr. Gray was also active in all the larger technical societies and received one of the few medals awarded in his field by the Franklin Institute.

MARKET APPRAISAL OF CHEMICAL INDUSTRY

NET earnings of the American I. G. Chemical Corp. for the fiscal year ended March 31, 1931, amounted to $2,322,952. This compares with $2,088,442 for the eleven months ended March 31, 1930, as reported in the first annual report of the corporation, which was organized on April 26, 1929. Total income for the fiscal year just ended amounted to $4,252,987, as against $3,786,562 for the previous period. Net income after deducting all expenses and taxes, but before debenture interest, amounted to $3,969,066, compared with $3,556,771 last year.

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Liquid Carbonic Corp. reports for six months ended March 31, 1931, net loss of $314,172 after interest and depreciation. This compares with net profit for the six months ended March 31, 1930, of $291,027 after charges and federal taxes, equal to 85c. a share on 342,406 no-par shares of common stock.

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Report of Associated Rayon Corp. for year ended Dec. 31, 1930, shows net profit of $795,529 after expenses, federal taxes, etc., equivalent to $3.97 a share on 200,000 shares of 6 per cent preferred stock. This compares with net profit in 1929 of $1,611,378.

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I. G. Farbenindustrie A. G. has declared a dividend of 12 per cent for 1930, which is the rate paid in 1929. The company reports gross profit for year ended Dec. 31, 1930, of 217,480,000 reichsmarks, compared with 256,480,000 reichsmarks in the previous year. After deducting interest, taxes, and depreciation, net profit for 1930 was 89,220,000 reichsmarks, against 104,598,000 reichsmarks in 1929.

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Net earnings of the Newport Co. for the first quarter of 1931 was $240,931 after all charges. This was equivalent to 41c. a share on the 521,220 shares of common stock after deducting dividends on the class A convertible shares. The net profit was 11 per cent in excess of the average quarterly net income for the year 1930. The statement of A. A. Schlesinger, president, said that earnings had been affected by unprofitable operations in the wood distillate divisions due to poor marketing conditions in rosin and turpentine existing since the middle of 1930.

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Net incomes of companies operating in the chemical and related fields, as reported for the first quarter of this year, compare as follows with the corresponding period of 1930:

	First Quarter 1931	First Quarter 1930
Air Reduction	$1,019,040	$1,523,276
Am. Com. Alcohol	124,837	175,349
Atlas Powder	157,291	350,697
Bon Ami	295,271	321,160
Certain-teed Products	233,892*	550,564*
Commercial Solvents	537,544	750,492
Corn Products	2,389,379	3,152,343
Dupont	12,656,929	17,347,626
General Printing Ink	208,393	217,457
Hercules Powder	216,459	731,535
Industrial Rayon	13,364	359,439
Lambert Company	2,110,307	2,068,267
Mathieson Alkali	297,403	541,946
Monsanto Chemical	255,378	293,170
National Distillers	301,565	204,496
Sharp & Dohme	276,418	273,010
Texas Gulf Sulphur	2,448,198	3,803,701
Union Carbide	4,613,670	6,472,783
Westvaco Chlorine	223,439	239,762

*Net loss.

Price Range Jan.-April, 1931 High	Low	Stock	Price Range in April April 1	High	Low	April 30
19½	5	Agfa Ansco Corporation	18¼	19½	12¾	14
109⅞	77⅞	Air Reduction	91½	95½	77⅞	83½
182¾	116¼	Allied Chemical	140½	143½	116¼	124⅝
224	140½	Aluminum Company of America	186½	188½	143	155
29¾	14¼	Am. Ag. Chemical, Del.	...	22½	14¼	15
14½	5¾	Am. Commercial Alcohol	8½	9⅛	5¾	6½
12¾	6¾	American Cyanamid, B.	9¼	9¼	6¾	7½
8	1⅞	American Hide & Leather	6¼	7¼	4⅝	...
23¾	14¾	American Metals	19¼	19¼	14¼	16
4½	1⅞	Am. Solvents & Chemical	2½	2¾	1¼	...
18	10	Archer-Daniels-Midland	14	14¼	10	11¾
4½	2	Armour, Ill., A	2½	2¼	2	2
23⅝	12½	Atlantic Refining	17¾	19¼	12½	15¼
54	34	Atlas Powder	42¼	42¼	34	35
62	50	Beechnut Packing	59	62	52	54½
1⅞	1¼	British Celanese	...	1⅝	1¼	...
25	25	California Petroleum	...	25	25	...
7¼	2¼	Certain-teed	5	6⅛	3½	4
12¾	10½	Chickasha Cotton Oil	...	11½	10½	10⅜
50½	43½	Colgate-Palmolive-Peet	47⅞	47¼	43½	43¼
111⅛	65¼	Columbian Carbon	80¼	84¼	65¼	72⅛
21½	12¼	Commercial Solvents	17¼	17¾	12¼	13¼
86⅝	62½	Corn Products	79⅝	80¼	62½	67¼
23	11½	Davison Chemical	16	17¼	11½	13¼
19⅛	13	Devoe & Raynolds, A	...	17¼	13¾	...
51	45	Dow Chemical	...	48⅛	48	...
107	77⅞	Du Pont	95	97⅞	77⅞	83
124	118¾	Du Pont, 6 p.c., deb.	123¼	124	120	...
3¼	1⅞	Duval Texas Sulphur	2⅛	2½	1⅞	...
185¾	143⅞	Eastman Kodak	162	165	147	155½
19¾	13	Firestone Tire	...	16½	13	15½
⅞	½	Fisk Rubber	⅝	¾	½	⅝
43¼	27¾	Freeport Texas Sulphur	36¾	38½	27¾	30¼
47	20⅞	General Asphalt	31⅛	33	20⅞	22½
16⅛	8⅝	Glidden	10½	11⅜	8¼	8⅞
42⅝	31½	Gold Dust	39	40½	34¼	35⅞
20⅞	9	Goodrich Company	16¼	17⅜	9	11¾
58	44	Hercules Powder	50	50½	44	44
13	10	Heyden Chemical	...	12	10	...
4⅝	3¾	Imperial Chemical, Ltd.	...	4⅝	3¼	...
86	28½	Industrial Rayon	73	78	28½	34
5¼	2¾	Int. Ag. Chemical	3⅜	3½	2¼	2⅜
20½	13⅞	International Nickel	17½	18⅛	14⅛	15⅛
10¼	5½	International Paper, A	...	8½	5½	6
42	29¾	International Salt	36¼	36¼	29¾	32⅛
16½	10	Kellogg, Spencer & Sons	15	15	13	13
3½	1⅜	Kelly-Springfield	2⅜	2⅝	1½	1⅞
4¾	2¼	Lee Rubber & Tire	4½	4¾	2¼	...
34¾	24	Lehn & Fink	32	32	27¾	28¼
20⅞	11¼	Libby-Owens	...	20⅞	14½	19⅝
55⅛	29½	Liquid Carbonic	43	44	29½	31
17	11⅛	McKesson & Robbins	12⅞	13½	11⅛	12
31½	18⅜	Mathieson Alkali	25⅛	25½	18⅜	20½
26½	18½	Monsanto Chemical	23⅜	24	18½	22⅞
36⅛	19¾	National Distillers Products	31½	33⅞	24⅛	27
132	112¼	National Lead	...	121⅜	112¼	...
51	35	New Jersey Zinc	46⅜	46⅜	35	...
53	42	Newport Corp., A	...	48½	46	46¼
19½	9¼	Ohio Oil	12½	13⅜	9¼	10⅞
39¾	28½	Owens-Ill. Glass	33¾	33¾	28½	...
16⅜	7	Phillips Petroleum	9⅞	10⅝	7	8⅛
42½	33	Pittsburgh Plate Glass	...	40⅜	33	33
40½	36⅛	Pratt & Lambert	...	40½	40	...
71½	63	Procter & Gamble	68	69½	64⅜	66¾
11⅞	5¼	Pure Oil	8⅞	8⅞	5½	6
66⅛	60½	Sherwin-Williams	...	64⅜	60½	60¾
12	5⅛	Silica-Gel	...	7½	6	6⅜
15⅞	8½	Sinclair Oil	11⅜	12⅜	8½	9⅝
12⅞	5	Skelly Oil	8⅛	8⅞	5	5¼
51¾	33	Standard Oil, Cal.	42½	44¾	33	37
52½	33½	Standard Oil, N.J.	41⅜	44½	33½	37⅜
26	17⅝	Standard Oil, N. Y.	21⅛	22⅛	17¾	19
45¼	35	Sun Oil	40½	41½	35	35⅛
3½	2¾	Swan & Finch	...	2¾	2¾	...
30⅜	27¾	Swift & Company	...	..	..	27¾
9½	6	Tennessee Corporation	7	7⅜	6	6½
36¼	20	Texas Corporation	28	29⅛	20	22½
55¾	38½	Texas Gulf Sulphur	49⅞	50	38½	[illegible]
9	4½	Tidewater Assoc. Oil	6½	7	4½	5⅛
16	3⅜	Tubize-Chatillon, B	8	8¾	6⅛	6⅛
72	47⅞	Union Carbide	63	64⅞	47⅞	54½
26¾	14	Union Oil, Cal.	20⅞	21¾	14	17
28¾	13¾	United Carbon	17¾	19½	13¾	16⅞
77⅜	30½	U. S. Industrial Alcohol	39⅛	43¾	30½	33
15⅞	7	U. S. Leather, A	12¾	12⅞	7¾	8¾
20⅜	11¾	U. S. Rubber	16¼	17¼	12⅛	14¼
69¾	40	Vacuum Oil	53⅜	55½	40	43
76¾	37½	Vanadium Corporation	63⅜	66⅜	37½	42½
3¼	1¾	Va.-Car. Chemical	2¼	2¼	1⅛	1⅜
26¼	21½	Wesson Oil	...	24½	21½	22
40	19⅞	Westvaco Chlorine	30	34½	23	24
3¾	2	Wilson & Co.	...	2⅜	2	...

ECONOMIC INFLUENCES

on production and consumption of CHEMICALS

Chemical Production Follows Trend Of Consuming Industries

Large Outputs of Some Selections With Reductions in Other Lines

PRODUCTIVE activities in the chemical industry have been of a spotty character, because outputs have been regulated largely by the position of consuming branches. In some cases production has been speeded up beyond that of a year ago and in other instances falling off in distribution has been reflected in a contraction in production. Favorable prospects in the building, tire, plate glass, and automobile trades have given an impetus to production of chemicals, which are in demand in those fields.

On the other hand, the fertilizer trade has fallen far short of the levels ruling a year ago. Tag sales in 16 states for April were reported as 82 per cent of those for April, 1930, and tag sales in the Southern states for March were 27 per cent less than in the preceding year. Consumption of sulphuric acid in fertilizers likewise shows a sharp decline, the total for the first quarter of this year being almost 29 per cent under that for the corresponding period of last year.

OFFICIAL figures have not yet been released regarding production of sulphur, but based on taxes paid to the State of Texas, the output for the first quarter of this year was close to 650,000 tons, or more than 10 per cent larger than that for the first quarter of last year, although lower than that for the last quarter of 1930.

Sole-leather tanning operations during March showed a sharp decline from the same month of 1930, according to preliminary figures. Hides put into process for sole leather last month amounted to 949,000, or 27.4 per cent below March, 1930, bringing the total for the first quarter of this year to 2,890,000, or 28.6 per cent less than in the corresponding period of last year.

Finished sole-leather deliveries in March exceeded finished production by 240,000 sides. Deliveries in March aggregated 1,245,000 sides, 19.4 per cent larger than in February and 10 per cent above March, 1930.

From statistics now available the following comparisons may be drawn between activities in some of the chemical-consuming and chemical-producing industries for the first quarter of this year and the corresponding period of 1930:

Production	First Quarter 1931	First Quarter 1930
Acetate of lime, 1,000 lb.	23,150	26,098
Alcohol, denatured, pr. gal.	23,172	29,856
Arsenic, crude, ton	6,254	4,704
Arsenic, refined, ton	4,485	2,414
Automobiles, no.	668,131	1,000,023
Byproduct coke, 1,000 lb.	9,246	12,594
Methanol, crude, gal.	1,597,269	1,542,032
Methanol, refined, gal.	783,011	1,131,927
Methanol, synthetic, gal.	2,164,521	1,545,742
Plate glass, 1,000 sq.ft.	26,796	30,238
Vegetable oils, crude, 1,000 lb.	675,868	799,502
Vegetable oils, ref., 1,000 lb.	500,994	560,430
Consumption		
Cotton, bales	1,378,284	1,578,202
Wool, 1,000 lb.	112,649	119,152
Sulphuric acid in fertilizer production, ton	474,462	668,018
Paint, varnish and lacquer sales, value	$68,197,521	$87,835,329
Vegetable oils, crude, 1,000 lb.	827,782	911,532
Vegetable oils, ref., 1,000 lb.	373,518	380,467

In the above tabulation withdrawals of alcohol for denaturization are taken as representative of denatured alcohol production. Sales of paint, varnish, and lacquer are regarded as indicative of consumption, but as the totals are given in dollars it is apparent that the difference in volume in the two periods was less than that indicated by the respective values, because of the lower price level which prevailed this year.

AN encouraging factor is found in an estimate that motor vehicle production in the United States and Canada in April amounted to 348,909 units. This figure represents an increase of 21 per cent over the March total. The tire industry, which entered the year in a good statistical position, also has issued favorable reports, and from present indications production for the year will surpass the totals which had been previously set up as tentative objectives.

The Department of Agriculture has just reported that sales during the past winter of new turpentine cups of all types for use in the season of 1931-32 amounted to only 1,085,000, or 108½ "crops" of 10,000 cups each.

This is approximately 10 per cent of the number sold for the last season and is the smallest number sold for any season for which the department has collected this information.

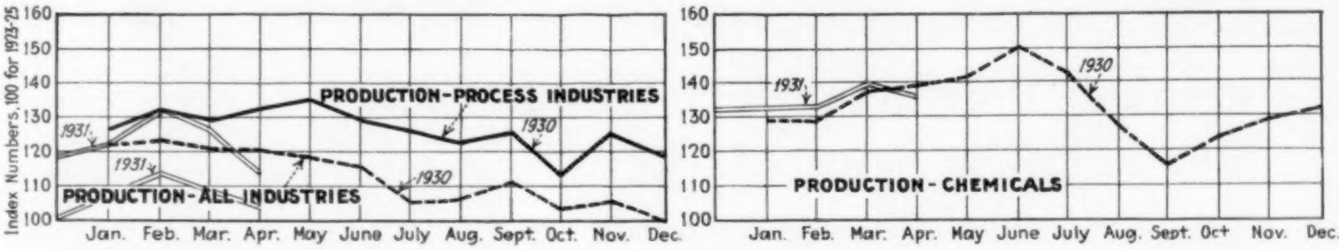
The small number of new cups purchased to replace old ones is a reflection of depressed conditions among the producers of naval stores, and according to trade opinions will likely result in a smaller quantity of the pale or higher grades of rosin. As a rule the number of new cups sold is an indication of the probable production for the coming season but it does not mean a proportionate reduction in the amount of Naval Stores produced.

Factory Production and Consumption of Vegetable Oils

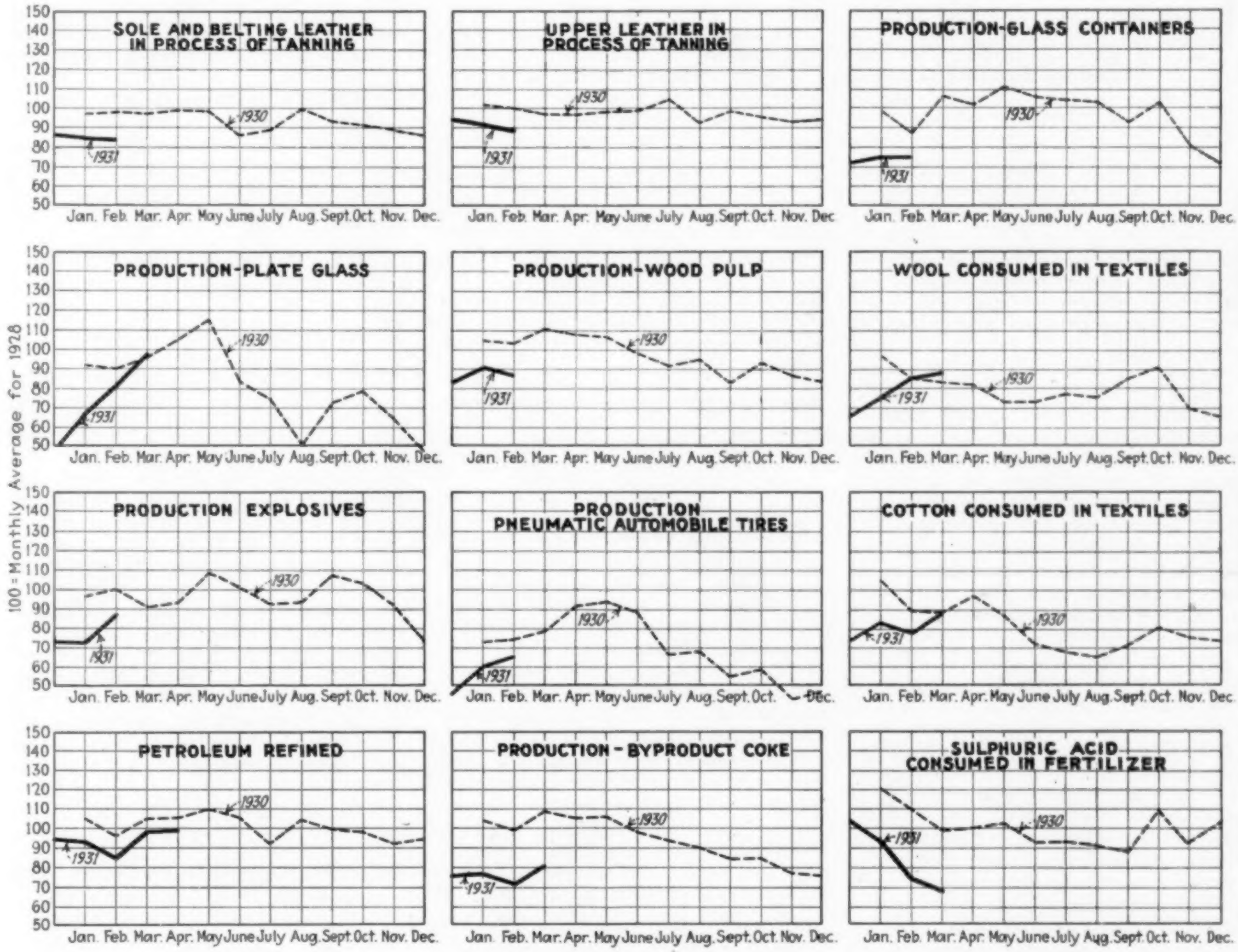
	Production		Consumption	
	First Quarter 1931 Lb.	First Quarter 1930 Lb.	First Quarter 1931 Lb.	First Quarter 1930 Lb.
Cottonseed oil, crude	395,406,614	500,203,812	436,875,300	493,203,812
Cottonseed oil, refined	396,855,042	449,577,650	276,905,542	287,591,151
Peanut oil, crude	5,214,362	12,112,350	4,806,717	4,440,557
Peanut oil, refined	4,089,847	3,033,645	3,072,400	2,258,184
Coconut oil, crude	91,445,505	90,688,722	138,254,541	166,131,337
Coconut oil, refined	66,268,268	76,800,662	75,479,461	78,593,942
Corn oil, crude	28,652,287	28,272,262	30,407,253	35,659,812
Corn oil, refined	26,129,525	26,611,404	8,898,894	6,296,682
Soya bean oil, crude	9,086,115	3,234,985	4,528,575	4,573,833
Soya bean oil, refined	2,108,114	788,506	2,138,775	2,049,011
Olive oil, edible	1,509,164	808,995	205,497	320,618
Olive oil, inedible	5,250	....	1,830,746	1,503,612
Palm kernel oil, crude	1,885,585	379,403	13,536,889	12,729,416
Palm kernel oil, refined	5,542,826	3,617,626	6,022,736	3,678,337
Linseed oil	118,417,218	145,969,802	74,091,829	95,601,333
Castor oil	12,212,958	15,583,860	4,489,677	5,460,350
Sesame oil	11,462,770	.........*	8,122,042	.........*
Rapeseed oil	....	....	2,389,819	3,038,087
China wood oil	....	....	22,765,025	24,974,543
Palm oil	....	....	74,432,367	49,425,711
Olive oil foots	....	....	10,088,570	9,929,217
Other oils	570,360	2,247,492	957,870	4,539,637

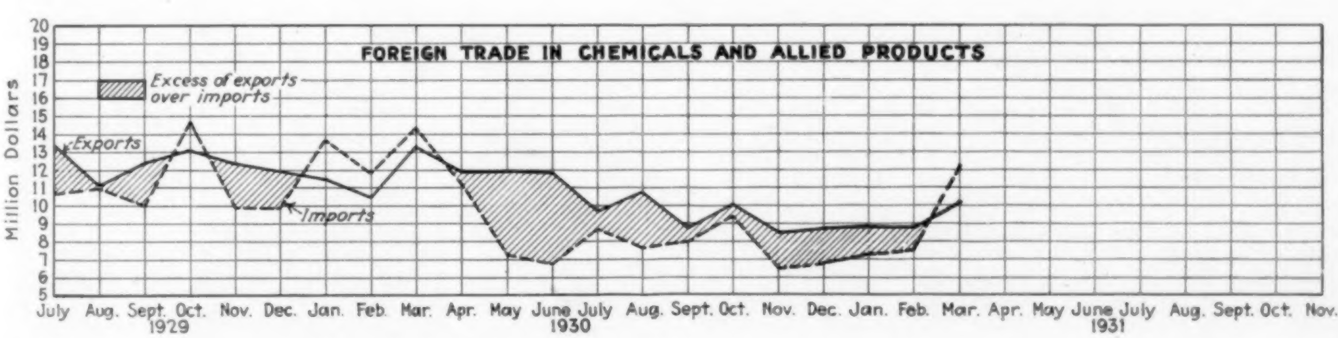
* Included in other oils.

ACTIVITY IN PRODUCING AND CONSUMING INDUSTRIES



Based on electrical power consumption, data supplied by Electrical World





MARKET CONDITIONS AND PRICE TRENDS

Chemical Products Meet Good Demand in Spot Market

Shipping Instructions Against Existing Contracts Do Not Meet Expectations

FAIRLY STEADY buying of chemicals has been reported in the spot market. This has been aided by the attitude of many consumers who have elected to take on stocks as needed rather than to commit themselves to long-term purchases. Conversely, deliveries against contracts have failed to attain the tonnage reported in preceding years. Shipping instructions against running contracts also have shown a tendency to decline and it is reported that producers have curtailed activities somewhat because of the disappointing nature of contract withdrawals.

Call for agricultural and insecticide chemicals has been good. It is pointed out that domestic production of arsenic for the first quarter of the year has run considerably higher than that reported for the corresponding period of last year without any increase in stocks; in fact, stocks of refined arsenic at the end of March were 2,181 tons, compared with 3,131 tons at the end of March, 1930. This may be partly accounted for by the fact that imports of white arsenic in the first quarter of this year were only 3,368,799 lb., compared with 5,497,510 lb. for the corresponding three-month period of last year. Copper sulphate also has moved in larger volume than a year ago.

AMONG developments abroad which attracted attention of domestic interests was a report that France would regulate its foreign trade in fertilizers and chemicals by a system of licenses. Our consul at Vera Cruz reported that the Department of Agriculture of the State Government of Vera Cruz has proposed the establishment of a plant for the fixation of atmospheric nitrogen for the purpose of making fertilizers for distribution among the farmers of the state at low prices. The proposal is to make fertilizers so as to avoid the necessity of importing commercial fertilizers. According to the proposal, a company is to be formed in which the taxpayers are to be invited to subscribe for stock.

Export trade in chemicals was larger in March than had been the case in the months immediately preceding, but the total for the first quarter was considerably under that of 1930. Among the chemicals which moved outward in larger volume than last year were copper sulphate, calcium arsenate, and sulphate of ammonia. Marked declines were registered in exports of sodium compounds.

Import trade in chemicals also gained in March, but not enough to offset the slower movement of the two preceding months, so that the quarter showed up unfavorably. With the exception of barium compounds and glycerine, practically everything listed in the chemical group was imported in smaller volume than a year ago.

IN VIEW of the fact that the Treasury Department announced in April that an anti-dumping order against salt cake imported from Germany was not justified, interest attaches to the recent report of the Department of Commerce which stated that domestic shipments of natural sodium sulphate last year amounted to 30,100 tons. This total includes salt cake and glaubers salt, but it is far ahead of the total of 7,540 tons reported for 1929. In verification of reports that salt-cake production in Canada was being expanded, it is now announced that production of natural sodium sulphate from deposits of Saskatchewan during 1930 amounted to 31,571 tons, valued at $293,847, as against 5,018 tons, worth $64,112 in 1929. The large increase was due to the demand for this material by a Canadian chemical company for the manufacture of niter cake at Coppercliff, Ontario, to be used in the smelting of nickel-copper ores.

The lower price level at which carbon black has been selling is explained by a review of the statistical situation. Production increased to a new high level in 1930 when it amounted to 379,942,000 lb., an increase over 1929 of 13,500,000 lb., according to the U. S. Bureau of Mines. This increase, coming after a gain in output in 1929 of 47 per cent, resulted in an oversupply, with the result that stocks continued to mount and prices to fall.

Total sales of carbon black to domestic and foreign buyers in 1930 amounted to 251,539,000 lb., a decline from the previous year of 32,267,000 lb. This decline was reflected in domestic sales and exports, both decreasing in about the same ratio.

The Franco-German Bromine Cartel

According to a report from Assistant Trade Commissioner E. C. Taylor, at Paris, the Franco-German bromine agreement is analogous with the potash accord of 1926 between the Societe Commercial d'Alsace and the Deutscher Kali Syndicat. Each company will reserve for itself the entire sale of the domestic markets. Foreign markets are divided, 70 per cent to the German and 30 per cent to the French producers up to a certain point, after which the exports will be divided equally between these two firms.

Production of Aluminum Salts in 1930

THE production of aluminum salts in the United States in 1930 was 351,267 short tons, valued at $9,772,086, as compared with 394,093 short tons, valued at $11,677,728, in 1929, a decrease of 42,826 tons, or 11 per cent in quantity, and of $1,905,642, or 16 per cent in total value, according to a statement of the U. S. Bureau of Mines.

The makers of aluminum salts consumed 67,736 long tons of domestic bauxite and 49,720 long tons of imported bauxite, a total of 117,456 tons, valued at $1,421,883 at consuming works. There was also consumed 4,473 short tons of alumina hydrate in the manufacture of the salts.

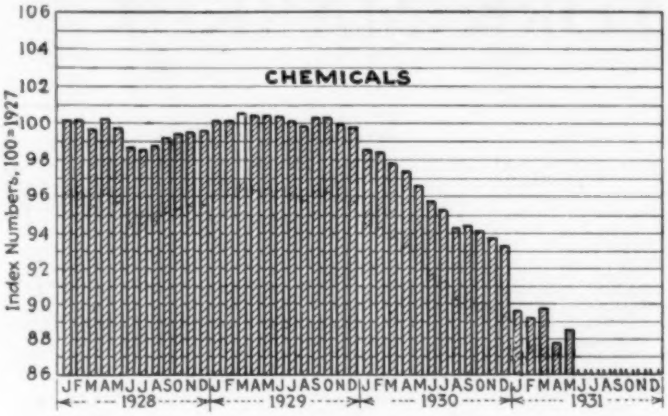
Exports of aluminum sulphate from the United States in 1930 were 25,255 short tons, valued at $573,234.

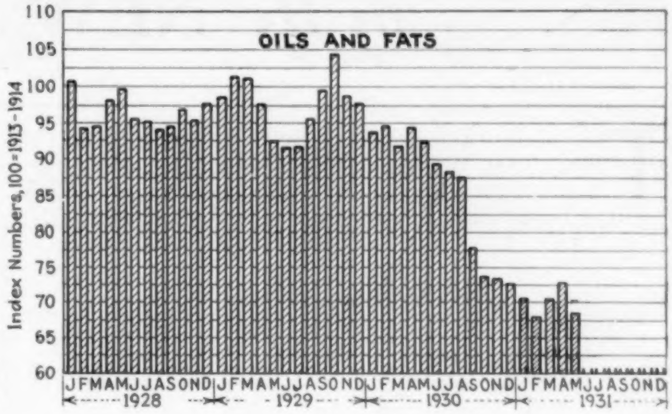
Production of Aluminum Salts in the United States in 1930

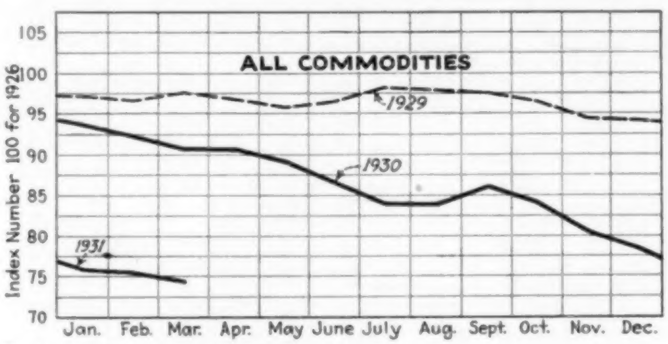
Salt	Number of Producers Reporting	Short Tons	Value
Alum:			
Ammonia	5	4,076	$228,986
Sodium	3	14,787	802,981
Potash	3	1,923	104,818
Aluminum chloride:			
Liquid	3	3,288	90,731
Crystal	3	583	53,363
Anhydrous	3	11,664	1,208,091
Aluminum Sulphate:			
Commercial—			
General	8	287,356	6,269,871
Municipal	6	7,544	125,857
Iron-free	5	16,866	598,871
Other aluminum salts and hydrate	*3	3,180	288,517
	..	351,267	9,772,086

*Two producers of alumina and one producer of sodium aluminate.

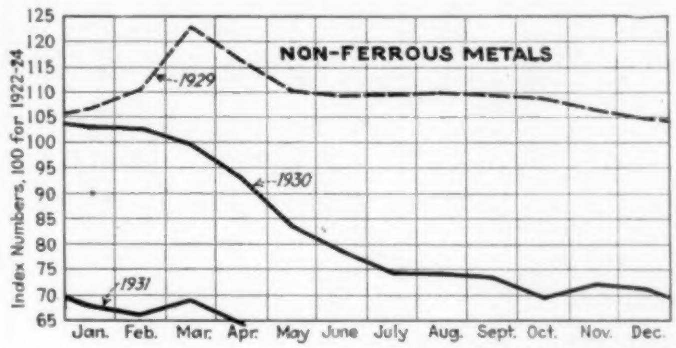
CHEM. & MET. *Weighted Indexes of* PRICES







U. S. Department of Labor



Engineering & Mining Journal

Lessening of Selling Pressure Steadies Chemical Market

ALTHOUGH lower production costs and the slower trading movement undoubtedly would have brought lower price levels for many chemicals, it is not probable that reductions since the first of the year would have gone as far as they did had not unusual selling pressure come into the market at the initiative of sellers. This is especially true with reference to alkalis, chlorine, and alcohol. During the last month selling pressure was not pronounced and the market as a whole assumed a steadier aspect. The depressed condition of metals had the effect of lowering costs for some of the salts, such as lead oxides and tin compounds, and this advantage was passed along to consumers, and price changes in general were dictated by market conditions and not by sales policies. This does not mean that all pressure has been removed from the market, for reports of price cutting still are heard, and some of these concern such basic chemicals as mineral acids.

Since selling competition is intensified by the accumulation of unsold stocks, there is encouragement in the belief in a steadier price level from reports that producers of certain chemicals which were not moving up to expectations had adopted curtailed production schedules. For some time views have been voiced to the effect that values had fallen to a point where further declines were improbable. This viewpoint is more tenable now than it was earlier in the year, but as prospective buying power is not heavy enough to arouse hopes of an early enhancement of values it seems logical to hold that present values can be maintained by holding production within the bounds of consuming demand.

Because some of the chemicals have declined in price more rapidly than others there appears to have arisen a condition where inter-commodity competition may force readjustments. For instance, in the solvents group some selections are selling at prices which make them attractive in directions where the preference usually has been given to other products.

With scarcely an exception the price trend of vegetable oils has been downward during the month. Fundamentally, values for oils and fats have suffered because of the large supplies, but many oils are affected by conditions in world markets. The effect of depressed conditions in foreign markets upon domestic demand for oils may be seen from the fact that our consumption of palm oil was much larger in the first quarter of this year than it was last year.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	**88.62**
Last month	87.86
May, 1930	96.54
May, 1929	100.31

Average prices for spirits of turpentine were sharply higher during the last month and brought about an advance in the weighted index number. Small lots of denatured alcohol also brought higher prices. Lead oxides and tin salts were lower.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1927

This month	**68.29**
Last month	72.27
May, 1930	92.24
May, 1929	92.52

Declines in price were fairly general throughout the list of vegetable oils and fats. Crude cottonseed, while largely nominal, was held at lower levels than a month ago. Linseed oil closed firm, but was easy for the greater part of the period.

CURRENT PRICES *in the* NEW YORK MARKET

THE following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to May 14.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.10 - $0.11	$0.10 - $0.11	$0.11 - $0.12
Acid, acetic, 28%, bbl., cwt	2.60 - 2.85	2.60 - 2.85	3.88 - 4.03
Glacial 99%, tanks	8.98	8.98 -	...... - ......
drs.	9.23 - 9.48	9.23 - 9.48	...... - ......
U. S. P. reagent, c'bys.	9.73 - 9.98	9.73 - 9.98	...... - ......
Boric, bbl, lb.	.06½ - .07	.06½ - .07	.06½ - .07
Citric, kegs, lb.	.37 - .38	.40 - .41	.46 - .47
Formic, bbl, lb.	.10 - .11	.10 - .11	.10½ - .11
Gallic, tech., bbl., lb	.50 - .55	.50 - .55	.50 - .55
Hydrofluoric 30% carb, lb	.06 - .07	.06 - .07	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11½ - .12	.11½ - .12	.11½ - .12
22%, tech., light, bbl., lb.	.05½ - .06	.05½ - .06	.05½ - .06
Muriatic, 18°, tanks, cwt.	1.00 - 1.10½	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 - 20.00	18.50 -	18.50 - 20.00
Oxalic, crystals, bbl., lb.	.11 - .11½	.11 - .11½	.11 - .12
Phosphoric, tech., c'bys., lb.	.08½ - .09	.08½ - .09	.08½ - .09
Sulphuric, 60°, tanks, ton	11.00 - 11.50	11.00 - 11.50	11.00 - 11.50
Tannic, tech., bbl., lb	.23 - .35	.23 - .35	.35 - .40
Tartaric, powd., bbl., lb.	.30½ - .33	.30½ - .33	.37½ - .39
Tungstic, bbl., lb.	1.40 - 1.50	1.40 - 1.50	1.40 - 1.50
Alcohol, ethyl, 190 p'f., bbl., gal.	2.33 -	2.33 -	2.63 - 2.71
Alcohol, Butyl, tanks, lb	.15½ -	.15½ -	.16½ - .17
Alcohol, Amyl	...... -	...... -	...... - ......
From Pentane, tanks, lb.	.236 -	.236 -	...... - .236
Denatured, 188 proof			
No. 1 special dr., gal	.27 -	.27 -	.43 - ......
No. 5, 188 proof, dr., gal.	.27 -	.27 -	.42 - ......
Alum, ammonia, lump, bbl., lb.	.03½ - .04	.03½ - .04	.03½ - .04
Chrome, bbl., lb.	.04½ - .05	.04½ - .05	.05½ - .06
Potash, lump, bbl., lb.	.03½ - .04	.03½ - .04	.03 - .03½
Aluminum sulphate, com., bags, cwt.	1.25 - 1.40	1.25 - 1.40	1.40 - 1.45
Iron free, bg., cwt.	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Aqua ammonia, 26°, drums lb	.02½ - .03	.02½ - .03	.03 - .04
tanks, lb	.02½ - .02½	.02½ - .02½	...... - ......
Ammonia, anhydrous, cyl., lb	.15½ - .15½	.15½ - .15½	.15½ ......
tanks, lb.	.05½ -	.05½ -	...... - ......
Ammonium carbonate, powd. tech., casks, lb	.10½ - .11	.10½ - .11	.11 - .12
Sulphate, wks., cwt	1.75 -	1.60 -	2.10 - ......
Amylacetate tech., tanks, lb., gal	.222 -	.222 -	.222 - ......
Antimony Oxide, bbl., lb.	.08½ - .10	.08½ - .10	.09 - .10
Arsenic, white, powd., bbl., lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs., lb	.09 - .10	.09 - .10	.09 - .10
Barium carbonate, bbl., ton	58.00 - 60.00	58.00 - 60.00	58.00 - 60.00
Chloride, bbl., ton	63.00 - 65.00	63.00 - 65.00	64.00 - 70.00
Nitrate, cask, lb.	.07 - .07½	.07 - .07½	.07 - .07½
Blanc fixe, dry, bbl., lb.	.03½ - .04	.03½ - .04	.03½ .04
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl., lb.	.033 -	.033 -	.033 - ......
Bromine, cs., lb.	.36 - .38	.36 - .38	.45 - .47
Calcium acetate, bags	2.00 -	2.00 -	4.50 - ......
Arsenate, dr., lb.	.06 - .07	.07 - .10	.07 - .08
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton.	20.00 -	20.00 -	20.00 - ......
flake. dr., wks., ton.	22.75 -	22.75 -	22.75 - ......
Phosphate, bbl., lb	.08 - .08½	.08 - .08½	.08 - .08½
Carbon bisulphide, drums, lb	.05 - .06	.05 - .06	.05 - .06
Tetrachloride drums, lb.	.06½ - .07	.06½ - .07	.06 - .07
Chlorine, liquid, tanks, wks., lb	.01½ -	.01½	.02½ - ......
Cylinders	.04 - .06	.04 - .06	.04½ - .06
Cobalt oxide, cans, lb.	1.75 - 1.85	1.75 - 1.85	2.10 - 2.25
Copperas, bgs., f.o.b. wks., ton	13.00 14.00	13.00 14.00	15.00 - 16.00
Copper carbonate, bbl., lb	.08½ .18	.08½ .17	.13 - .20
Cyanide, tech., bbl., lb.	.41 - .46	.41 - .46	.45 - .46
Sulphate, bbl., cwt	4.25 - 4.50	4.25 - 4.50	4.50 - 5.00
Cream of tartar, bbl., lb	.23½ - .24	.23½ - .24	.26½ - .27
Diethylene glycol. dr., lb.	.14 - .16	.14 - .16	.11 - .13
Epsom salt, dom., tech., bbl., cwt.	1.70 - 2.00	1.70 - 2.00	1.75 - 2.00
Imp., tech., bags, cwt	1.15 - 1.25	1.15 - 1.25	1.15 - 1.25
Ethyl acetate, drums, lb	.08 -	.08 -	.121 - ......
Formaldehyde, 40%, bbl., lb.	.06 - .07	.06 - .07	.07½ - .08
Furfural, dr., contract, lb	.10 - .12	.10 - .12	.15 - .17
Fusel oil, crude, drums, gal	1.30 - 1.40	1.30 - 1.40	1.30 - 1.40
Refined, dr., gal.	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Glaubers salt, bags, cwt.	1.00 - 1.10	1.10 - 1.20	1.00 - 1.10
Glycerine, c.p., drums, extra., lb.	.12½ - .13	.12½ - .13	.14 - .15
Lead:			
White, basic carbonate, dry casks, lb.	.07½ -	.07½ -	.07½ - ......
White, basic sulphate, sck., lb	.07 -	.07 -	.07½ - ......
Red, dry, sck., lb	.07½ -	.08 -	.09 - ......
Lead acetate, white crys., bbl., lb	.11 - .12	.11 - .12	.13 - .13½
Lead arsenate, powd., bbl., lb.	.11 - .14	.11 - .14	.13 - .14
Lime, chem., bulk, ton	8.50 -	8.50 -	8.50 - ......
Litharge, pwd., csk, lb	.06½ -	.07 -	.08 - ......
Lithopone, bags, lb.	.04½ - .05	.04½ - .05	.05½ - .06½
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.06 - .06½
Methanol, 95%, tanks, gal	.33 -	.33 -	.38 - ......
97%, tanks, gal.	.34 -	.34 -	.45 - ......
Synthetic, tanks, gal.	.37½ -	.40½ -	.40½ - .45
Nickel salt, double, bbl., lb.	.10½ - .11	.10½ - .11	.13 - .13½
Single, bbl., lb.	.10½ - .11	.10½ - .11	.13 - .13½
Orange mineral, csk., lb	.09½ -	.10 -	.11 - ......
Phosphorus, red, cases, lb	.42 - .44	.42 - .44	.42 - .44
Yellow, cases, lb.	.31 - .32	.31 - .32	.31 - .32
Potassium bichromate, casks, lb	.09 - .09½	.09 - .09½	.09 - .09½
Carbonate, 80-85%, calc., csk., lb	.05½ - .06	.05½ - .06	.05½ - .06
Chlorate, powd., lb.	.08 - .08½	.08 - .08½	.08½ - .09
Cyanide, cs., lb.	.55 - .57	.55 - .57	.52 - .55
First sorts, csk., lb.	.08½ - .09	.08½ - .09	.08½ - .09
Hydroxide (c'stic potash) dr., lb	.06½ - .06¾	.06½ - .06¾	.06½ - .06¾
Muriate, 80% bgs., ton	37.15 -	37.15 -	37.15 - ......
Nitrate, bbl., lb.	.05½ .06	.05½ - .06	.06 - .07½
Permanganate, drums, lb.	.16 - .16½	.16 - .16½	.16 - .16½
Prussiate, yellow, casks, lb	.18½ - .19½	.18½ - .19	.18½ - .19
Sal ammoniac, white, casks, lb	.04½ - .05	.04½ - .05	.047 - .05
Salsoda, bbl., cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk, ton	15.00 - 18.00	15.00 - 18.00	22.00 - 25.00
Soda ash, light, 58%, bags, contract, cwt.	1.15 -	1.15 -	1.32 - ......
Dense, bags, cwt.	1.17½ -	1.17½ -	1.35 - ......
Soda, caustic, 76%, solid, drums, contract, cwt.	2.50 - 2.75	2.50 - 2.75	2.90 - 3.00
Acetate, works, bbl., lb.	.04½ - .05	.04½ .05	.04 - .05
Bicarbonate, bbl., cwt.	1.85 - 2.00	1.85 - 2.00	2.00 - 2.25
Bichromate, casks, lb.	.07 - .07½	.07 - .07½	.07 - .07½
Bisulphate, bulk, ton	14.00 16.00	14.00 - 16.00	14.00 - 16.00
Bisulphite, bbl., lb.	.03½ - .04	.03½ - .04	.03½ - .04
Chlorate, kegs, lb	.05½ - .07½	.05½ - .07½	.07 - .08
Chloride, tech., ton	12.00 - 14.75	12.00 - 14.75	12.00 - 14.00
Cyanide, cases, dom., lb.	.16½ - .17	.16½ - .17	.18½ - .22
Fluoride, bbl., lb.	.08 - .08½	.08 - .08½	.08 - .09
Hyposulphite, bbl., lb.	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Nitrate, bags, cwt.	2.05 -	2.05 -	2.10 - ......
Nitrite, casks, lb.	.07½ - .08	.07½ - .08	.07½ - .08
Phosphate, dibasic, bbl., lb.	.0265 - .03	.0265 - .03	.03½ - .03¾
Prussiate, yel. drums, lb	.11½ - .12	.11½ - .12	.11½ - .12
Silicate (30°, drums), cwt.	.60 - .70	.60 - .70	.60 - .70
Sulphide, fused, 60-62%, dr., lb.	.02½ - .03½	.02½ - .03	.03½ - .04
Sulphite, crys., bbl., lb	.03 - .03½	.03 - .03½	.02 - .03
Sulphur, crude at mine, bulk, ton	18.00 -	18.00 -	18.00 - ......
Chloride, dr., lb.	.05 - .06	.05 - .06	.05 - .06
Dioxide, cyl., lb.	.06½ - .07	.06½ - .07	.07 - .08
Flour, bag, cwt.	1.55 - 3.00	1.55 - 3.00	1.55 - 3.00
Tin bichloride, bbl., lb.	nom. -	nom. -	nom. - ......
Oxide, bbl., lb.	.26 -	.28 -	.40 - ......
Crystals, bbl., lb	.24 -	.25½ -	.29½ - ......
Zinc chloride, gran., bbl., lb.	.06½ - .06¾	.06½ - .06¾	.06½ - .06¾
Carbonate, bbl., lb.	.10½ - .11	.10½ - .11	.10 - .11
Cyanide, dr., lb.	.41 - .42	.41 - .42	.40 - .41
Dust, bbl., lb.	.05½ - .06	.06 - .07	.07½ - .08
Zinc oxide, lead free, bag, lb.	.06½ -	.06½ -	.06½ - ......
5% lead sulphate, bags, lb.	.06½ -	.06½ -	.06½ - ......
Sulphate, bbl., cwt.	3.00 - 3.25	3.00 - 3.25	2.75 - 3.00

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.10½ - $0.11	$0.10½ - $0.11	$0.12 - $0.13
Chinawood oil, bbl., lb.	.06½ -	.07 -	.10½ - ......
Coconut oil, Ceylon, tanks, N.Y., lb.	.04½ -	.05 -	.06½ - ......
Corn oil crude, tanks, (f.o.b. mill), lb.	.07½ -	.07½ -	.07½ - ......
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.06½ -	.06½ -	.07½ - ......
Linseed oil, raw, car lots, bbl., lb.	.09 -	.09 -	.14 - ......
Palm, Lagos, casks, lb	.05 -	.06 -	.07 - ......
Niger, casks, lb.	.04½ -	.05½	.07 - ......
Palm Kernel, bbl., lb.	.05½ -	.05½	.07½ - ......
Peanut oil, crude, tanks (mill), lb	.07 -	.07	.07½ - ......
Rapeseed oil, refined, bbl., gal.	.46 - .48	.56 - .58	.68 - .70
Soya bean, tank (f.o.b. Coast), lb	nom. -	nom. -	.09½ - ......
Sulphur (olive foots), bbl., lb.	.05½ -	.05½ -	.07½ ......
Cod, Newfoundland, bbl., gal.	.42 - .45	.42 - .45	.55 - .57
Menhaden, light pressed, bbl., gal	.34 - .36	.34 - .36	.63 - .65
Crude, tanks (f.o.b. factory), gal.	.20 -	nom. -	nom. - ......
Whale, crude, tanks, gal	.78 -	.78 -	- .80
Grease, yellow, loose, lb.	.03½ -	.03 -	.05½ - ......
Oleo stearine, lb.	.07½ -	.08½ -	.08½ ......
Red oil, distilled, d.p. bbl., lb	.08½ -	.08½	.10½ ......
Tallow, extra, loose, lb	.03½ -	.03½ -	.05½ ......

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 - $0.65	$0.60 - $0.65	$0.60 - $0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.80 - .85
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.14½ - .15	.14½ - .15	.15 - .16
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .52
Anthracene, 80%, drums, lb.	.60 - .65	.60 - .65	.60 - .65

Coal-Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr., lb.	1.10 - 1.25	1.10 - 1.25	1.15 - 1.25
Benzidine base, bbl., lb.	.66 - 67	.65 - .67	65 - .67
Benzoic acid, U.S.P., kgs, lb.	.57 - 60	.57 - .60	57 - .60
Benzyl chloride, tech., dr., lb.	.30 - 35	.30 - .35	30 - .35
Benzol, 90%, tanks, works, gal.	.20 - 21	.20 - .21	21 - .22
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr., lb.	.14 - 17	.14 - .17	.14 - 17
Cresylic acid, 97%, dr., wks., gal.	.54 - 58	54 - .58	.60 .70
Diethylaniline, dr., lb.	55 - 58	.55 - .58	.55 - .58
Dinitrophenol, bbl., lb.	.29 - .30	.29 - .30	30 - 31
Dinitrotoleun, bbl., lb.	.16 - 17	.16 - .17	.16 - .17
Dip oil, 25% dr., gal.	.26 - 28	.26 - .28	26 - 28
Diphenylamine, bbl., lb.	.38 - 40	.38 - .40	39 40
H-acid, bbl., lb.	.65 - .70	.65 - .70	68 .70
Naphthalene, flake, bbl., lb.	.03¾ - .04¼	.03¾ - .04¼	.04½ .05
Nitrobenzene, dr., lb.	.08½ - .09	.08½ - .09	.08½ - .10
Para-nitraniline, bbl., lb.	.51 - .55	.51 - .55	.51 - 55
Para-nitrotoluine, bbl., lb.	29 - .30	.29 - .31	.29 - 31
Phenol, U.S.P., drums, lb.	14½ - .15	.14½ - .15	.14½ .15
Picric acid, bbl., lb.	.30 - .40	30 - .40	.30 - 40
Pyridine, dr., lb.	1 50 - 1.75	1 50 - 1.80	1.50 - 1.80
R-salt, bbl., lb.	40 - .44	.40 - .44	44 - 45
Resorcinal, tech., kegs, lb.	1 15 - 1 25	1.15 - 1.25	1.15 - 1.25
Salicylic acid, tech., bbl., lb.	33 - .35	33 - .35	.33 - .35
Solvent naphtha, w.w., tanks, gal	25 - .30	25 -......	.28 - .30
Tolidine, bbl., lb.	86 - 88	86 - .88	.91 - .93
Toluene, tanks, works, gal.	.30 -...	30 -......	.35 -.....
Xylene, com., tanks, gal.	.25 - 28	25 - .28	.28 - .30

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl., lb.	.07½- .11	.07½- .11	.14 - .16
China clay, dom., f.o.b. mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.03 - 20	.03 - .20	.05 - .22
Prussian blue, bbl., lb.	.35 - .36	.35 - .36	.35 - .36
Ultramine blue, bbl., lb.	.06 - 32	.06 - .32	.03 - .35
Chrome green, bbl., lb.	27 - 28	27 - 28	.27 - .30
Carmine red, tins, lb.	5.00 - 5 40	5.00 5.40	6.00 - 6.50
Para toner, lb.	75 - 80	75 - 80	.77 - 80
Vermilion, English, bbl., lb.	1 70 - 1 80	1 70 - 1 80	1.90 - 2.00
Chrome yellow, C. P., bbl., lb.	16½- 17	16½- .17	.17 - .17½
Feldspar, No. 1 (f.o.b. N.C.), ton	6 50 - 7 50	6 50 - 7 50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	07 - .08½	.07 - .08½	.04 - .05
Gum copal Congo, bags, lb.	.06 - .08	.06 - .08	.07½- .08
Manila, bags, lb.	.16 - .17	.16 - .17	.16 - 17
Damar, Batavia, cases, lb.	.16 - .16½	.16 - .19	.18 - 19
Kauri No. 1 cases, lb	.45 - .48	.45 - 48	48 - 53
Kieselguhr (f.o.b. N. Y.), lb.	50.00 -55.00	50.00 -55.00	50.00 -55 00
Magnesite, calc, ton.	40.00 -......	40.00 -......	40.00 -......
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - 07
Imported, casks, lb.	03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	6.35-......	6.35 -......	7.10 -......
Turpentine, gal.	.55¾-	.54½-......	.48 -......
Shellac, orange, fine, bags, lb	.38 - .40	.41 - .42	.55 - .58
Bleached, bonedry, bags, lb.	.30 - .31	.30 - .31	.38 - .40
T. N. bags, lb.	.16 - .17	.18½- .19	.27 - .28
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10 00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	9.50 -......
300 mesh (f.o.b. Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 -......	13.75 -......	13.75 -......

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl., lb.	$0 20 -$0 22	$0.20 -$0.22	$0.27 -$0 29
Beeswax, ref., light, lb.	.28 - .30	.26 - .30	.36 - .38
Candelilla, bags, lb.	.14½- .15	.13½- .14	.19 - .20
Carnauba, No. 1, bags, lb.	nom.-......	.21½- .22	.31 - .32
Paraffine, crude			
105-110 m.p., lb.	.03¼- .03¾	.03½- .03¾	.04⅛- .05

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton.	$200.00-.....	$200.00-.....	$200.00-...
Ferromanganese, 78-82%, ton.	80.00-85.00	80.00-85.00	94 00 99.00
Spiegeleisen, 19-21%, ton.	30.00-.....	30.00-.....	33.00 .....
Ferrosilicon, 14-17%, ton.	39.00-.....	39.00-.....	45.00-.....
Ferrotungsten, 70-80%, lb.	1.10.....	1.10-.....	1.45-.....
Ferrovanadium, 30-40%, lb.	3.15- 3.50	3.15- 3.50	3.15-3.50

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb.	$0 09-......	$0.10 -......	$0.12½-......
Aluminum, 96-99%, lb.	233	.233	.24 - .25
Antimony, Chin. and Jap., lb.	.06¾ -......	.07¼-	.08 -......
Nickel, 99%, lb.	.35 -.....	.35 -......	.35 - .....
Monel metal, blocks, lb.	.28 -......	.28 -......	28 -.....
Tin, 5-ton lots, Straits, lb.	.22¾-......	.26 -......	31¾-.....
Lead, New York, spot, lb.	03¾-.....	.045-	.055 - .....
Zinc, New York, spot, lb.	.0335-......	.0435-.....	.05 -.....
Silver, commercial, oz.	.28 -.....	.28½ -.....	.42¾ .....
Cadmium, lb.	.55 -	.55 -......	.70 ......
Bismuth, ton lots, lb.	1.50 -	1.40 -......	1.70 - .
Cobalt, lb.	2.50 -	2.50 -......	2 50 - .....
Magnesium, ingots, 99%, lb.	.48 -......	.48 -......	85 - 1.10
Platinum, ref., oz.	23 00	30 00-......	46 00 ......
Palladium ref., oz.	19.00- 21.00	19.00- 21.00	30 00 35.00
Mercury, flask, 75 lb.	101 00- . .	102.00-......	112 00- . . .
Tungsten powder, lb.	1.65-......	1 65-......	1.70- 1.75

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton.	$6 50- $8.25	$6.50- $8.25	$7.50 $8.00
Chrome ore, c.f. post, ton.	19.00- 24 00	19.00- 24 00	21.50 25.00
Coke, fdry., f.o.b. ovens, ton.	2 75- 2 85	2 75- 3 85	2.75 2.85
Fluorspar, gravel, f.o.b. Ill., ton.	17 25- 20.00	17.25- 20.00	18 00- 20.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit.	.24 - .25	.25 - .27	.31 - 36
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb.	.35 - .40	35 - .40	48- .50
Monazite, 6% of ThO_2, ton.	60.00 -.....	60 00 -.....	60.00-......
Pyrites, Span. fines, c.i.f., unit.	.13 -...	13 -....	.13 -......
Rutile, 94-96% TiO_2, lb.	.10 - .11	.10 - .11	.10 - .11
Tungsten, scheelite, 60% WO_3 and over, unit.	11.25 - 11.50	11.00 -12.50	15 25 -16.50

CURRENT INDUSTRIAL DEVELOPMENTS

New Construction and Machinery Requirements

Acetylene Gas Manufacturing Plants—Union Carbide & Carbon Co., 30 East 42nd St., New York, N. Y., postponed construction of acetylene gas manufacturing plants (Prest-O-Lite units) at Canton, O. and Syracuse, N. Y. $150,000 each. Projects in abeyance.

Ammunition Plant Development—Bureau of Yards & Docks, Navy Dept., Washington, D. C., will receive bids until June 17 for development of Naval Ammunition plant including 131 buildings, 11½ mi. railroads, 14¾ mi. paved roads, electrical, telephone and water supply systems at Oahu, Hawaii. Spec. 6101.

Asphalt Manufacturing Plant—Standard Paving & Materials Ltd., Toronto, Ont., plans the construction of an asphalt manufacturing plant at Kitchener. Estimated cost $100,000.

Brass Factory—American Brass Co., Grand and Meadow Sts., Waterbury, Conn., awarded contract for addition and alterations to factory on Canal St., Ansonia to Charles Smith & Sons Inc., 101 Water St., Derby. Estimated cost $100,000.

Bronze Foundry—General Bronze Corp., 34-19 10th Ave., Long Island City, N. Y., will not construct additions to plant. $500,000 to $1,000,000. Project in abeyance.

Calcium Chloride—Borough Council, Forty-Fort (Wilkes-Barre) Pa., will receive bids until June 1 for 100 tons of calcium chloride in carload lots.

Caliche Development—J. B. Sneed, Post, Tex., and S. C. Campen, Temle, Tex., acquired caliche deposits on Belton-Kileen Highway, plan development.

Carbon Plant—Ohio Carbon Co., J. E. Schunck, Secy., and Treas., 12508 Berea Rd., Cleveland, O., is having preliminary plans prepared for a 1 story addition to factory. Estimated cost $40,000. George S. Rider Co., Marshall Bldg., Cleveland, is architect and engineer.

Cellophane Plant—Du Pont Cellophane Co., 2 Park Ave., New York, N. Y., and River Rd., Buffalo, awarded separate contracts for addition to plant at Buffalo. Estimated cost $2,000,000. Engineering Department of Buffalo, in charge.

Chemical Mixing Equipment—City of Grand Forks, N. D., plans to purchase chemical mixing equipment for waterworks.

Chemical Plant — Mallinckrodt Chemical Works, West Side Ave., Jersey City, N. J., awarded contract for a 1 story, 75 x 155 ft. chemical plant to James Mitchell Inc., 24 Journal Sq., Jersey City. Estimated cost $40,000.

Chemical Plant—Southern Alkali Corp., c/o American Cyanamid Corp., 535 5th Ave., New York, N. Y., A. Wells, in charge, plans the construction of a chemical plant to include several large manufacturing units, accessories, loading docks, warehouses, electric lighting unit, etc., on a 350 acre site at Corpus Christi, Tex. Estimated cost approximately $10,000,000. Private plans.

Colortype Plant—American Colortype Co., 207 West 25th St., New York, N. Y., is having revised preliminary plans made for altering and constructing plant at Allwood, N. J. Estimated cost $40,000. Ballinger Co., 12th and Chestnut Sts., Philadelphia, Pa., is architect and engineer.

Concrete Magazine — Constructing Quartermaster, Ayer, Mass., plans the construction of concrete magazine at Camp Devens. Private plans.

Copper Rod Rolling Mill—Eugene F. Phillips Electrical Works, Brockville, Ont., awarded contract for the construction of a copper rod rolling mill to Dominion Engineering Works Ltd., Lachine, Montreal, Que. Estimated cost $225,000.

Gas Manufacturing Plant—Corp., c/o Johnson Church & Co., 149 Broadway, New York, N. Y., Engrs., plans the construction of a gas manufacturing plant at Hartsville, S. C. Estimated cost to exceed $40,000. Awarding separate contracts.

Gas Plant—Ontario Shore Gas Co., W. Chatfield, Mgr., Genosho Hotel, Oshawa, Ont., acquired the Oshawa gas plant and will extend system, mains, etc., including new water gas generator. Estimated cost $100,000. Private plans.

Gas Retorts—Lake Shore Gas Co., Richmond and Simcoe Sts., Oshawa, Ont., plans installing gas retorts and erecting storage building, also gas mains to Whitby and Baumanville and extending mains in Oshawa and Baumanville. Estimated total cost $155,000.

Gas Testing Station—Philadelphia Gas Works Co., Broad and Chestnut Sts., Philadelphia, Pa., awarded contract for a 1 story, 31 x 51 and 11 x 47 ft. gas testing station at 7th St. and Passyunk Ave. to F. A. Havens Co., 845 North 19th St., Philadelphia.

Gypsum Factory—United States Gypsum Co., c/o J. H. Nold, Ch. Engr., 300 West Adams St., Chicago, Ill., awarded contract for a 1 story mill building at Warren, O., to H. K. Ferguson Co., Hanna Bldg., Cleveland. Estimated cost $200,000.

Plaster Mill, Board Plant, Etc.—Canadian Gypsum Co., D. R. Rodgers, Ch. Engr., Toronto, Ont., is having plans prepared for a plaster mill, wall board plant and warehouse at Willow Grove, also at Oneida. Estimated cost $150,000 and $100,000 respectively. Equipment for Oneida plant will be required.

Laboratory—Buffalo General Hospital, High St., Buffalo, N. Y., plans the construction of a hospital, including laboratory. Estimated cost $400,000. Kidd & Kidd, 524 Franklin St., Buffalo, are architects.

Laboratory — Dept. of Health, Division of Laboratories & Research, Capitol, Albany, N. Y., awarded contract for alterations and extensions to main laboratory building to W. J. Murray Construction Co., 41 South Pearl St., Albany.

Laboratory, Etc.—Bd. of Education, 500 Park Ave., New York, N. Y., is having sketches made for the construction of a high school including science laboratory, etc., at Jamaica Ave. and 76th St., Brooklyn. Estimated cost $3,000,000. W. C. Martin, Flatbush Ave. Ext. and Concord St., Brooklyn, is architect.

Medical Manufacturing Plant — Petrolagar Laboratories Inc., 536 Lake Shore Drive., Chicago, Ill., awarded contract for the construction of first unit of medical manufacturing plant at McCormick Blvd. and Cleveland Ave., Niles Center, to Regan Construction Co., 228 North La Salle St., Chicago. Estimated cost $250,000.

Leather Factory—Carr Leather Co., 111 Foster St., Peabody, Mass., awarded contract for the construction of a 5 story, 45 x 100 ft. factory to E. H. Porter Construction Co., 15 Wallis St., Peabody. Estimated cost to exceed $40,000.

Linoleum Factory—Paraffine Co. Inc., 475 Brannan St., San Francisco, Calif., awarded contract for a linoleum factory at Emeryville to MacDonald & Kahn, Financial Center Bldg., San Francisco. $50,000.

Match Factory—Mississippi Match Co., Natchez, Miss., awarded contract for the construction of a factory including two warehouses and five outbuildings at Jackson to W. G. Wetmore Construction Co., Jackson. $125,000.

Paper Plant—International Paper Co., 220 East 42nd St., New York, N. Y., plans reconstruction of woodroom and sulphur tower destroyed by fire at Corinth, N. Y. Estimated cost to exceed $40,000.

Paper Plant—Ontario Paper Co., Allanburg Rd., Thorold, Ont., plans additions and alterations to plant to increase production, first unit 2 story, 50 x 144 ft. Estimated total cost $500,000. J. Stadler, 1117 St. Catharine St. W., Montreal, Que., is engineer.

Petroleum Products Plant—American Mineral Spirits Co., 205 East 42nd St., New York, N. Y., is having preliminary plans prepared for petroleum products plant and tanks at Carteret, N. J. Estimated cost $40,000. Architect not announced. Maturity after May 15.

Pottery Plant — Harker Pottery Co., East Liverpool, O., acquired plant of E. M. Knowles China Co. and plans construction of three new tunnel kilns and factory additions at Chester, W. Va. Estimated cost $150,000. Equipment will be required.

Refinery Equipment—Atlantic Refinery Co., 620 South Broad St., Philadelphia, Pa. and 291 Broadway, New York, N. Y., awarded contract for twenty-two enchangers and refinery equipment for plant at Point Breeze (West Philadelphia) Pa. to Alco Products Co., subsidiary of American Locomotive Co., Dunkirk, N. Y. Estimated cost to exceed $100,000.

Refining Equipment—Union Socialist Soviet, Russia, c/o Amtorg Corp., 261 5th Ave., New York, N. Y., awarded contract for oil refining equipment in connection with plant in Caspean Sea District, Russia to Alco Products Inc., subsidiary of American Locomotive Co., Dunkirk, N. Y. Estimated cost $1,250,000.

Refinery Unit—Kendall Refining Co., J. B. Fisher, in charge, Kendall Ave., Bradford, Pa., awarded contract for a re-run still unit to Alco Products Co., subsidiary of American Locomotive Co., Dunkirk, N. Y., refrigeration system to York Ice Machine Co., York, Pa., and chilling tower to M. B. Miller, 501 5th Ave., New York. $154,000; also will soon award contract for a 2 story, 30 x 60 ft. laboratory. Private plans.

Refinery (Oil) — Elwerath Gewerkschaft, Hanover, Germany, awarded contract for the construction of an oil refinery at Misburg, near Hanover, Germany, to A. G. McKee Co., 2422 Euclid Ave., Cleveland, O. Estimated cost $1,000,000.

Refinery (Oil)—Vacuum Oil Co., 61 Broadway, New York, N. Y., will build an oil refinery at Harve, France. Estimated cost $2,000,000 to $4,000,000. Work will be done by day labor and separate contracts. Equipment let to Foster Wheeler Inc., 165 Broadway, New York.

Refinery (Sugar)—International Sugar Co., 637 Battery St., San Francisco, Calif., is having preliminary plans prepared for the construction of a sugar refinery at Los Angeles. Estimated cost $2,000,000.

Rolling Mill—Ingersoll Machine Tool Co., E. A. Wilson, Mgr., Ingersoll, Ont., acquired London Rolling Mills and is interested in prices on additional equipment for the manufacture of cold-drawn steel, also new furnace. Estimated cost $50,000.

Rubber Plant—American Hard Rubber Co., Boonton Ave., Butler, N. J., awarded contract for addition and alterations to plant 1 story, 95 x 275 ft. to Walter Kidde & Co., 140 Cedar St., New York, N. Y. Estimated cost $150,000.

Rubber Products Plant — Bickett Rubber Products Co., Watertown, Wis., moving plant to Anderson Ind. to be located at West 25th St. and Martindale Ave. Plant will be reconditioned and new machinery added.

Salt Plant—Arden (Vancouver) Salt Co., 85 West First Ave., Vancouver, B. C., awarded contract and construction started on a 1 story, 88 x 135 ft. plant. Estimated cost $34,000, exclusive of equipment.

Limestone Plant — Chemical Lime Co. Inc., Bellefonte, Pa., plans to expend $200,000 for new equipment and plant extension. This unit produces pulverized and ground limestone for glass trade, agriculture, etc.

Silica Products Plant—Silica Products Co., Inc., c/o D. D. Dunkin, Harrison, Ark., is having preliminary plans prepared for the construction of a silica products plant at Everton. Estimated cost $75,000. Work will be done by owner's forces.

Smel'er Plant—Eastern Smelting & Refining Co., 109 West Brookline St., Boston, Mass., plans reconstruction of plant recently destroyed by fire. Estimated cost $40,000. Private plans.

Soap and Perfume Factory—Lever Bros., 370 7th Ave., New York, N. Y., are having preliminary plans prepared for remodeling old American Can Co. plant into factory for the manufacture of soaps, perfumes, etc., at River Rd., Edgewater, N. J. Estimated cost $40,000. Stone & Webster Inc., 120 Broadway, New York, N. Y., are architects and engineers.

Steel Plant Expansions—Pacific Coast Steel Corp., 215 Market St., San Francisco, Calif., acquired a 17 acre site and plans plant expansions including open hearth, angle mill and enlarge forge pressing facilities at Slauson Ave. and Atlantic Blvd., Los Angeles.

Tar Products Plant—Canadian Bitumuls Ltd., Kent Bldg., Toronto, Ont., awarded contract for the construction of a 1 story tar products plant at Leaside to Goldie Construction Co., 32 Church St., Toronto. Estimated cost $50,000. Private plans.

Tar and Tar Products Plant—Dominion Tar & Chemical Co., H. O., 606 Cathcart St., Montreal, Que., plans addition to tar and tar products plant ft. of Logan Ave., Toronto, Ont. Estimated cost $250,000. Private plans.

Vitamin Plant—Letisine Vitamin Co. Inc., c/o C. Dickens, 4 Key Route Arcade, Oakland, Calif., will build a vitamin plant at Salinas, by day labor. Estimated cost $75,000.

INDUSTRIAL NOTES

INTERNATIONAL FILTER Co. has moved its general offices to 59 East Van Buren St., Chicago, Ill.

RILEY STOKER CORP., Worcester, Mass., and the BADENHAUSEN CORP., Cornwells Heights, Pa., have consolidated under the name of the former concern.

SULLIVAN MACHINERY Co., Chicago, Ill., has appointed Edwin T. Hall manager of the Boston office to succeed the late G. H. Richey.

PERIN & MARSHALL, consultants, have dissolved the firm, and Perin Engineering, Inc., has been formed at 11 West 42d St., New York City.

C. J. TAGLIABUE MFG. Co. has moved its Pittsburgh branch into larger quarters at 1027 Park Building.

FOOTE BROS. GEAR & MACHINE Co. has moved its general offices to 215 North Curtis St., Chicago.

FORD, BACON & DAVIS CONSTRUCTION CORP. has been formed as a subsidiary of Ford, Bacon & Davis, Inc., to handle all its construction activities.

ROBINSON CLAY PRODUCTS Co., New York City, has moved its offices to the Empire State Building, New York City.

ISOLANTITE Co. OF AMERICA, INC., Belleville, N. J., has changed its name to Isolantite, Inc.

STONE & WEBSTER AND BLODGETT, INC., are now located at 90 Broad St., New York.

C. W. HUNT Co., INC., West New Brighton, S. I., has been absorbed by the Gifford-Wood Co., Hudson, N. Y.

INTERNATIONAL STACEY CORP. is the new name of the combined Stacey Engineering Co. and International Derrick & Equipment Co., and all subsidiary companies will be known as divisions.

SWANN CORP., Birmingham, Ala., has appointed F. W. Miller in charge of the Cincinnati office, at the Carew Tower, with J. R. Morehead as his assistant.

BRISTOL Co., Waterbury, Conn., has moved its Pittsburgh office to the Koppers Building.

STEPHENS-ADAMSON MFG. Co., Aurora, Ill., has appointed C. H. Adamson district manager at the new Chicago offce, 20 North Wacker Drive.

ROLLER-SMITH Co., New York City, has appointed Commercial Engineering Co., 18 East St., Washington, D. C., as its sales agent.

HAMMOND & LITTEL have removed their offices to 22 East 40th St., New York.

ORROK, MYERS & SHOUDY, consulting engineers, have moved their offices to 21 East 40th St., New York.

GENERAL CERAMICS Co. has moved its home office to 71 West 35th St., New York.

DAYTON-DOWD, Quincy, Ill., has appointed M. D. MacNeille Western sales manager, located at San Francisco.

FRED S. CARVER Co. has moved its offices to 345 Hudson St., New York City.

YEOMANS BROS. Co., Chicago, Ill., has appointed the following representatives: Andriot Davidson Co., Louisville, Ky.; Johns Equipment Co., Fort Wayne, Ind.; and H. A. Grossman Co., St. Louis, Mo.

LINK-BELT Co., Chicago, Ill., has appointed W. L. Hartley sales manager at 5938 Lensdale Ave., Detroit, Mich.

CHILEAN NITRATE OF SODA EDUCATIONAL BUREAU has moved its offices to 120 Broadway, New York City.

YAMATAKE Co. has transferred all its business to the Imperial Export Co., 11 Moore St., New York City.

MORRIS MACHINE WORKS have moved their Chicago office to 211 West Wacker Drive.

CHARLES T. WILSON Co., INC., has moved its offices to 99 Wall St., New York.

MERCO NORDSTROM VALVE Co. has moved its Boston office to 250 Stewart St.

KORFUND COMPANY, INC., has moved to its new plant at 48, 32d Place, Long Island City, N. Y.

RAMET CORPORATION OF AMERICA has been formed by the Fansteel Products Co., Inc., North Chicago, Ill., to take over the rights on hard cutting metals.

CHICAGO BRIDGE & IRON WORKS has moved its Dallas office to the Burt Building, in charge of H. B. Murphey.

ROLLWAY BEARING Co., INC., Syracuse, has appointed E. C. Bonistall manager of the Cincinnati office.

BLAW-KNOX Co., Pittsburgh, Pa., has acquired all rights to certain machinery of the American Tractor & Equipment Co., Oakland, Calif.